AGGREGATE MERGER ACTIVITY

AND THE BUSINESS CYCLE

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ABSTRACT

This study examines macroeconomic and industry-level factors (with particular emphasis on the business cycle) on industry-level merger activity. In a sample of US mergers from 1979 to 2006, we find that industry level mergers are highly pro-cyclical. The business cycle has a positive and significant impact on both horizontal and non-horizontal mergers, even after controlling for other macroeconomic and industry-level effects. Although macroeconomic variables have similar effects on both horizontal and non-horizontal mergers, industry-level factors vary significantly between the two types of mergers. Horizontal mergers are much more aligned with neo-classical theories, while non-horizontal mergers are more affected by financing constraints and overvaluation. We also find that the determinants and financing preferences of industry-level mergers vary greatly across the business cycle stages, which suggests that the motivation for mergers changes in different economic conditions.

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CHAPTER 1
INTRODUCTION

A considerable amount of both theoretical and empirical literature has been devoted to the study of mergers and acquisitions. The empirical literature has provided many important insights about the characteristics of acquirers and targets, short-term market reactions to merger announcements, long-term post merger performance of the combined firm, and agency issues. However studies examining the primary causes of aggregate merger activity have been less conclusive. Many notable characteristics of aggregate mergers, such as the fact that they occur in waves, are still not fully understood. This is not surprising considering conflicting predictions as to whether mergers and acquisitions are mainly motivated by agency problems or by a pure economic objective - maximizing shareholder's wealth.

This thesis explores this issue further by examining the impact that business cycle fluctuations have on industry-level merger activity. Our main objective is to determine whether the amount of merger activity and the primary motivations for acquisitions change significantly across different business cycle stages.

In the last 15 years, merger activity research has started to shift from analyzing aggregate mergers to industry-level and firm level mergers. These more recent studies generally fall into two groups: First, the behavioral theories reason that agency problems and asymmetric information are the main drivers of aggregate mergers. They argue that managers are most likely to be engaged in mergers and acquisitions in times of a favorable transaction environment, which occurs when the acquirer's stock is overvalued. Merger waves are, therefore, likely to be a result of market timing (Schleifer and Vishny (2003), Rhodes-Kropf and Viswanathan (2004), Ang and Cheng (2006)). Second, the neoclassical theories assume that mergers serve as efficient tools for

allocating assets within an industry. Studies such as Gort (1969), Morck et al. (1988), Mitchell and Mulherin (1996), Andrade, Mitchell and Stafford (2001), Andrade and Stafford (2004), and Harford (2005) argue that changes in the industry-level business environment cause a need for asset restructuring within that industry, which in turn affects the volume of merger activity. However, when it comes to the causes of the changes in business environment, the vast majority of these studies focus on the industry-level technological, regulatory and economic shocks.

It remains unclear whether macroeconomic factors have any explanatory power after controlling for these more specific motivations. Mitchell and Mulherin (1996, p.195) suggest that "a fruitful research design would consider the joint effect of macroeconomic and industry-level factors in modeling the behavior of takeovers over time". This study attempts to accomplish this by examining the effect of one particularly important macroeconomic variable, the business cycle, on industry-level merger activity.

The business cycle may affect industry-level mergers through two channels. First, the general economic activity associated with the business cycle affects industry performance and shifts in aggregate demand, both of which are expected to have a significant impact on the demand for mergers and acquisitions. For example, Becketti (1986) finds that in times of high industry growth mergers can be used to increase output in the short-run. Compared to direct investment, mergers have an advantage of increasing the firms' output much faster. Accordingly, Jensen (1993) argues that in times of low industry growth, mergers can also be used as consolidating tools effectively removing excess capacity within an industry.

Second, the business cycle may also affect the transaction environment of mergers. Through this channel, the business cycle has a direct impact on merger profitability and plays a significant role in the timing of mergers. The empirical literature, for example, Melicher,

Ledolter and D'Antonio (1983), demonstrate that both interest rates and stock prices affect aggregate mergers. Nominal interest rates are affected by money demand, which in turn is influenced by economic conditions.[1] The stock prices and investor optimism are also procyclical, which means that a bulk of stock financed, overvaluation driven mergers will be procyclical. We expect that the business cycle contains information about the transaction environment that is not captured with the traditional proxies, namely interest rates and stock prices. For example, the business cycle could provide additional information on the type as well as the amount of debt used to finance mergers, since numerous studies have shown that the term structure of interest rates is strongly influenced by the business cycle (e.g. Labadie, 1994).

Two notable studies that examine the relationship between aggregate mergers and the business cycle, Markham (1955) and Nelson (1959), provide conflicting results. Markham examines the correlation between the total number of mergers and the business cycle on an annual basis between the periods 1887-1904 and 1919-1939. He concludes (p. 151) that the correlation between the business cycle and mergers is, "…. only a little better than that which would be expected of two time series moving at random." Using the total number of quarterly mergers from 1919 to 1954 as the proxy of merger activity, Nelson (1959) examines the association of merger activity with the business cycle by comparing the turning points of each time series. In addition to reporting a significant relationship between these two series, he finds that the turning points of these two series either coincide or that the mergers lead the business cycle by two to four quarters. A more closely related and more recent empirical study is Becketti (1986), which examines the extent to which certain business cycle–related macroeconomic variables (interest rates, stock prices, Gross Domestic Product (GDP) and capacity utilization) affect merger activity in the short and long-run. He finds that interest rates and capacity

[1] Similarly money supply is affected by the business cycle through Central Bank policy.

utilization affect the merger activity the most and that mergers are pro-cyclical: increasing in booms and decreasing in recessions.

Our study, however, differs from the existing literature in several ways. First, existing studies do not identify the types of mergers (horizontal, vertical or conglomerate), and hence, fail to distinguish the motivations behind each type. We accomplish this by separately studying the effect of the business cycle on horizontal (related) and non-horizontal (unrelated or vertical) mergers. Second, unlike early merger studies, we focus on industry level mergers and control for industry-level characteristics and shocks. Finally, existing studies rely on proxies of the business cycle that fail to capture a wide range of an economy's business activities, for example, they use only one macroeconomic series (e.g. Gross Domestic Product (GDP), Gross National Product (GNP), production index, aggregate capacity utilization or the aggregate unemployment rate). Most of these variables on their own have limited ability to capture changes in the business and market conditions of an economy. These variables are also very sensitive to economic shocks, seasonality, and other factors not related to the business cycle. In contrast, this paper measures economic activity using the index developed by Stock and Watson (1999) and maintained by the Federal Reserve Bank of Chicago, also known as Chicago Fed National Activity Index (CFNAI). The CFNAI, which is derived from 85 existing economic indicators, is a much more comprehensive measure of current U.S. economic activity than traditional proxies.[2]

Using panel tests and monthly industry-level aggregate merger data from 1979 to 2006, we find a significant positive relationship between the business cycle and both horizontal and non-horizontal mergers. Our findings are robust after controlling for various industry and macroeconomic variables, such as interest rates and market returns. We find that the business cycle is one of the most important factors in predicting the occurrence of mergers within an

[2] Further details on the Index and creation of the business cycle variable are given in section 4.2

industry, as well as predicting the starts of industry merger waves. We also find that the industry-level motivations and financing preferences change across different business cycle stages, suggesting that mergers are used for different roles at different stages of the economy. The fact that merger motivations vary across business cycle stages is further supported by the observed differences in characteristics of horizontal and non-horizontal acquirers in those stages. For example, the market-to-book ratio of non-horizontal acquirers is higher in the boom and peak stages of the cycle, while during the same periods the operating performance (cash and sales values) are significantly higher for horizontal acquirers. Finally, we find significant differences between the type of mergers (horizontal vs. non-horizontal) and their determinants, financing preferences, and timing with respect to the business cycle.

CHAPTER 2
PRIOR RESEARCH

Research in Mergers and Acquisitions (M&A) is very broad, and a great number of studies have examined topics like market reaction to merger announcements, to post merger performance of acquiring firms, determinants of merger performance, motives behind M&A, and so on. These studies reveal a number of characteristics and motives of mergers that might help explain patterns in aggregate merger activity. Therefore, in addition to reviewing prior research on aggregate mergers, this chapter also examines some of the findings in other relevant M&A areas. The chapter is organized in two sections. Section 1 provides a brief background to mergers and acquisitions, as well as a review of empirical results which give us a better understanding of the role of mergers in general. Section 2 reviews studies that are specifically concerned with aggregate merger characteristics.

2.1 Background to Mergers and Acquisitions

Types of Mergers

There are three basic types of mergers: Horizontal, vertical and conglomerate. Each one acts as a valuable restructuring tool for a company, depending on its needs. If a company wishes to have a higher market share and at the same time eliminate one of its competitors, it would likely choose a horizontal merger. If the company wants to have a higher control over its supplies, distribution of its product or both, it will be involved in vertical mergers. And finally if a firm wants to eliminate some of its business risk by diversifying in other firms, or if there are only limited opportunities for growth in its own industry, it will find a conglomerate merger to be most useful.

Reasons for Mergers/acquisitions

Many studies have examined the motivations involved in mergers and acquisitions. The most common reasons are synergy, company growth, reducing excess capacity, overvaluation, and diversification. A brief description of each motivation is given below.

Synergy:

When the value of the merged companies is higher than the sum of their individual values, synergy between these companies exists. In such a case, there is an obvious incentive for the two firms to merge. Some of the more common types of synergies include:

i) Increased market share: Although this is a benefit in theory, the U.S. has very strict anti-trust regulation so that the benefits of merging for the purpose of significantly increasing market share are very small. Several studies test this hypothesis indirectly by measuring the abnormal returns of related but non-merging firms. They argue that if mergers were

used to increase market share and thereby industry concentration, the remaining companies would raise their product prices, which would in turn increase their share price. Empirical evidence however, does not support this view, for example Stillman (1983) and Eckbo (1981) find that merger announcements have no significant effects on the share prices of firms directly competing with them.

ii) Cost reduction: In a horizontal merger, most of the cost savings come from economies of scale, while in a vertical merger they come from economies of scope (e.g. Maloney and McCormick (1988)).

In any potential merger, a large number of company-specific synergies exist, and since there is a high level of uncertainty it is very hard to estimate the dollar value of these benefits. There are many cases where the acquirer over-estimates the benefit of synergy in a merger and pays a significantly higher price for a target (Schleifer and Vishny (2003)).

Company growth:

Another reason why a company might choose to merge is due to managerial objectives to grow the company through acquisitions. Managers might have many reasons to maximize their firm's growth. For example their salary could be tied to their company's growth or they might get higher utility from the prestige of managing a large firm (Khorana and Zenner (1998), Morck et al. (1990)). Mueller (1969) argues that large growth oriented firms have a lower rate of return and when interest rates increase, their cost of capital will exceed expected return. This results in fewer investment opportunities and the company may choose to acquire smaller firms which have a higher expected return in order to grow. Managers might also want to pursue the growth objective through mergers in order to prevent other firms from acquiring them. Gorton, Kahl

and Rosen (2005) argue that managers will acquire other firms, even if the mergers decrease shareholder wealth, as a takeover defense mechanism.

Excess capacity:

If a large number of firms in an industry experience excess capacity, the assets in the industry as a whole will not be efficiently utilized (thus aggregate ROA will decrease). In such an event, firms have two choices: first, they can shrink through internal mechanisms, such as downsizing or selling excess plant and equipment. This however does not always work effectively, because there are agency costs and conflicts of interest between managers and the shareholders. The second way is to merge, and in doing so the firms will eliminate redundant processes and will be able to use the remaining assets more efficiently (Andrade and Stafford (2004)). This was the motive for a significant number of mergers in the 1980's because at the time the economy underwent dramatic technological advances which created excess capacity in many industries (Jensen 1993).

Overvaluation:

The proponents of this theory argue that information asymmetry exists between managers of a firm and the market, with managers being more informed about the true value of their firm. When their firm is overvalued, the managers have an incentive to use their overvalued stock to acquire other companies, because the acquirer's cost of capital will be lower from their point of view. The managers maximize their shareholders' value by exchanging their over-valued stock for another company's real assets (Schleifer and Vishny (2003), Rhodes-Kropf and Viswanathan (2004)).

Diversification:

Diversification is a major reason behind conglomerate (unrelated) mergers. A merger is said to be diversifying if a firm acquires or merges with another firm in a different industry. The management of the acquirer firm is usually not very familiar with the target firm's industry, and this often outweighs any potential benefits of diversification. In fact, most of these types of mergers under perform their benchmarks (Servaes, 1996).

Value Creation of Mergers and Acquisitions

A large number of M&A studies examine the profitability of mergers, whether they create value for the shareholders both in the short and long-term, and the sources of those gains. These results are important, particularly since various aggregate merger theories provide different predictions about the role of mergers in the economy and subsequently their effect on shareholder wealth.[3]

Most of the literature that examines the short term value-creation of mergers studies the market reaction of merger announcements. They assume that the value loss/gain of the merger will be reflected in the abnormal returns during the announcement. Three common results are found in these studies: 1) The abnormal return of the target firm is positive 2) The abnormal return of the acquirer is negative[4] 3) The combined abnormal return of the 2 firms is slightly positive. See for example Morck, Schleifer and Vishny (1990) and Roll (1986). However, many uncertainties exist between announcement date and completion date and as a result the true value of the merger might not be reflected in the abnormal stock returns immediately after announcement (e.g. Franks, Harris and Titman (1991), Agrawal, Jaffe, and Mandelker (1992),

[3] See section 2.3.2 for further details

[4] The negative market reaction to the acquirer's stock might not entirely reflect the profitability of a merger. For example, Mitchell, Pulvino and Stafford (2004) find that *merger arbitrage* plays a large role in the downward pressure on acquirer stock during the announcement.

Loughran and Vijh (1997)). Andrade, Mitchell and Stafford (2001), find that cumulative abnormal returns between the announcement and completion date are 10% and 3% higher for the target and acquirer, respectively, than the abnormal returns during the day of the announcement.

2.3 Merger Wave Studies

Studies devoted to aggregate merger activity began in the 1950's. Markham (1955) and Nelson (1959) are among the first studies to demonstrate the cyclical characteristics of aggregate mergers, and examine their relationship with various macroeconomic variables. Over the years a large number of theories have emerged to explain these characteristics, and some of the major studies are reviewed in this section.

The literature review is divided into two parts. 1) The first part presents a brief summary of studies which examine only macroeconomic factors and their effect on aggregate merger activity. Two sets of variables can be found in most of these studies: capital market condition variables and current economic conditions variables. 2) The second part summarizes studies that go a little deeper into the motivation for mergers. These studies break down mergers by industry, classify the mergers as horizontal, vertical or conglomerate, and assign firm-specific, industry-wide and economy-wide variables to explain aggregate mergers. They are classified into two major theories: Neoclassical and Behavioral.

2.3.1 Macro-level studies

Time series studies

The most prominent characteristic of aggregate mergers is the cyclical wave pattern (e.g. Town (1992)). Globe and White (1993) fit a series of sine curves to the time series data (aggregate mergers in the mining and manufacturing sector), and find that their fitted sine wave

model is very close to the actual time-series data, concluding that the merger movements follow a pattern which can be characterized as a wave. Shughart and Tollison (1984) on the other hand find evidence against the wave hypothesis. When considering the number of mergers per year, the data follows a random walk process, but when the nominal value of mergers is used, the data follow an AR(1) process. However Lin and Zhu (1997) argue that a series can follow an AR(1) process and still be considered a wave. They show that aggregate mergers follow two distinct AR(1) processes during periods of high and low merger activity.

A number of studies attribute this pattern to various macroeconomic variables, which can be generally categorized into two major groups: a) those that represent current (or future) economic conditions and b) those that represent current capital market conditions.

Current economic conditions

This theory argues that mergers will increase if current economic conditions are favorable, that is if there is an economy-wide optimism of future economic growth. The stock market prices are usually used as a proxy of the current optimism about future performance, and in fact most early studies find a positive relationship between the stock market index and merger activity (e.g. Nelson (1959, 1966), Weston (1961), Gort (1969), Melicher, Ledolter, D'Anotnio (1983)).[5] Of course many other explanations have been given for this relationship. Gort (1969) argues that in times of high stock prices, economic disturbances that lead to valuation discrepancies between the buyer and seller increase, and it is because of these discrepancies that an increase in aggregate mergers occurs. Other macroeconomic variables that fall into this theory are the GNP and GDP. However, these variables might lag the aggregate merger activity. Melicher, Ledolter, D'Antonio (1983) argue that if the current business conditions theory is

[5] Although these studies agree that a positive relationship exists between mergers and stock prices, they disagree which one is affected by the other. Nelson (1959) and Becketti (1986) argue that a merger increase affects stock price increases, while Melicher, Ledolter and D'Antonio argue the exact opposite.

correct, in light of current optimism about future economic growth, firms will merge to gain immediate operating capacity, which in turn will lead to an increase in industrial production. Other studies show mixed results. Nelson (1959) finds a significantly positive relationship between merger activity and industrial activity for the period 1895-1920 and again for 1919-1954 (Nelson (1966)). However, Weston (1961) finds no significant relationship between mergers and industrial activity for a period 1919-1940. In a slightly different study, Becketti (1986) finds a positive relationship between merger activity and the GDP during the period 1948-1985. Furthermore, he finds that merger activity grows faster in expansions and more slowly in recessions.

Capital market conditions

The second theory argues that mergers are affected by capital market conditions. If the short-term and/or long-term interest rates increase, the borrowing costs will increase, and as a result the costs of mergers are more likely to offset the benefits.[6] Becketti (1986) finds that the aggregate number of mergers is influenced by 3 month T-Bills more than any other macroeconomic variable.

A few studies have directly compared the explanatory power of the two theories. Melicher, Ledolter and D'Antonio (1983) find only a weak relationship between merger activity and economic conditions, but a significant relationship between mergers and market conditions. Benzing (1991) compares the two theories before and after the Celler-Kefauver act and finds that although both conditions influence aggregate mergers, capital market conditions have become the dominant determinant after 1950.

[6] This is especially true if a large number of acquirers borrow money to finance mergers (leveraged buyouts). Andrade, Mitchell and Stafford (2001) show that a large number of mergers (30%-45%) were financed this way in the last 25 years, particularly in the 1980's.

The fact that no single theory seems to explain aggregate merger activity has been a common theme in many studies. Mueller (1969) and Schwartz (1984) examine various merger models and conclude that no model by itself can explain even a significant fraction of the merger activity in the last century. However, during small intervals of time (around 3-5 years) one theory seems to explain a larger number of mergers, while in the next interval that theory becomes insignificant and another takes its place.

2.3.2 Industry/Firm level studies

All of the studies mentioned until now, with the exception of Gort (1969), try to explain aggregate mergers without clarifying any particular mechanism(s) involved. Their main emphasis is to determine which variables, or sets of macroeconomic variables, explain the most merger activity without paying any particular attention to the type of merger, type of industry, or any firm-specific conditions that might play a role in the firm's decision to merge. In contrast, the studies in this section take those factors into account. As a result, the focus of these studies shifts towards various motivations of mergers, not only explaining aggregate merger activity, but answering such questions as why mergers are concentrated in certain industries, why do they often result in wealth loss, and why do aggregate mergers almost always coincide with high stock market levels.

Gort (1969) is the first to observe that distribution of mergers varies widely across industries and over time and implies that factors other than the macroeconomic variables have to be included in a model for aggregate merger activity. In the last ten years almost all of the research has dealt with aggregate mergers from an industry-level or firm-level perspective. This research can be categorized into two groups: Neoclassical theories and Behavioral theories of merger waves.

2.3.2.1 Neoclassical theories

In the neoclassical group of theories, the authors follow classical economic assumptions, in this case the most important being capital market efficiency and that managers maximize shareholders' wealth. One of the most accepted neoclassical theories argues that a large part of aggregate mergers are triggered by industry-specific shocks which cause firms in an industry to reorganize, and the most efficient way to do this within a particular industry is via mergers or acquisitions. Some supporting evidence of this theory is given by Song and Walkling (2000), who find that stock prices in an industry appreciate after a merger announcement in that industry. They argue that the stock appreciation is due to the anticipation of more mergers to come in that industry, which should increase the industry's overall capital utilization. Andrade and Stafford (2004) find that acquirers outperform their non-merging counterparts. This point is also confirmed by Hasbrouck (1985) who finds that acquirers are on average managing their assets more efficiently than takeover targets.

The strength of this theory is that it can predict an important characteristic of aggregate mergers: mergers are highly clustered within a few industries and over short periods of time (Mitchell and Mulherin (1996), Mulherin and Boone (2000), Andrade, Mitchell and Stafford (2001)). For example Mitchell and Mulherin (1996) find that more than 50% of all mergers in the 1980's occurred in 7 industries which contained only 14% of the market's equity value. These few industries are not special in the sense that they dominate or cause aggregate merger waves over decades; in fact these dominant industries change very frequently over time.[7] A great deal of empirical research has found a positive relationship between the number of mergers in an

[7] Andrade, Mitchell and Stafford (2001) find that industries that had a significant portion of aggregate mergers in one decade were no more likely to have a significant portion of mergers in the following decade relative to a low merger industry.

industry and the magnitude of industry shocks that immediately precede the mergers (e.g. Harford (2005), Mitchell and Mulherin (1996)). Harford (2005) also argues that industry shocks drive aggregate mergers, however sufficient aggregate capital liquidity is required in order to set off large-scale merger waves.

Regardless of whether industry shocks are positive or negative, they have a similar impact on merger and acquisitions. Andrade and Stafford (2004) provide evidence that in times of high growth prospects within an industry, mergers serve the same purpose as capital investment. However, in times of industry-wide excess capacity, mergers are the principal way for the industry as a whole to contract.

The q-theory of mergers can be considered a neoclassical theory if we assume capital market efficiency. In this theory, as the firm's Q ratio rises, not only does its investment rate rise, but also its probability to acquire another firm. Jovanovic and Rousseau (2002) find that the change in a firm's Q ratio has a higher effect on M&A investment than it does on direct investment. They find evidence that firms with higher Q ratios will acquire firms with lower Q's (Similar to Hasbrouck (1984) results). Because acquirers have higher Q's than the targets, they argue that (p.198) "mergers are a channel through which capital flows to better projects and better management".

If we relax the assumption of capital market efficiency, this theory can be categorized in the behavioral class. Rhodes-Kropf, Robinson, and Viswanathan (2004) find that firms with a higher Q do not necessarily have better management or better growth opportunities. They break down the Market/Book ratio in the following way: M/B= M/true value * true value/B. The first term represents the degree of misevaluation of the firm, which in neoclassical theory is assumed to be 1. They find that merger intensity is positively related to deviations between the short and

long run valuations (i.e. dispersion of the first term). This is similar to the neoclassical Q theory except that the high dispersion of Q's is due to misevaluation within an industry.

A fundamental problem with the neoclassical theories of mergers is that they cannot explain an important fact: the abnormal returns and long term performance of acquirers following a merger are below average. If mergers lead to more efficient use of capital within an industry, shouldn't acquirers perform above average? One explanation is given by Mitchell and Mulherin (1996) and Harford (2005). They argue that all firms within an industry restructure either internally or externally following a shock, depending on their underlying characteristics. Their performance will therefore differ after the shock, and because of that a true benchmark cannot be constructed. So even if we observe a negative performance after the merger, no one can say that the acquirer's performance wouldn't be even worse in the absence of the merger. In this case, the mergers are still beneficial to shareholders, it is the economic shocks that have caused the acquirer, and in fact the entire industry, to have the observed negative returns. Other researchers argue that the neoclassical theory only predicts that the combined returns of both target and acquirer will be positive. Jensen and Ruback (1983), Brickley and Netter (1988) and Andrade Mitchell and Stafford (2001) find that although the combined returns are positive at the announcement date, target firms on average earn positive abnormal returns and acquirers earn negative abnormal returns. Andrade Mitchell and Stafford (2001) find that this characteristic persists not only in the short term (1 day prior and post announcement) but during the whole period between announcement and completion date.

2.3.2.2 Behavioral theories

The behavioral theories relax the assumptions of market efficiency and/or manager wealth maximization. They argue that mergers are not always in the best interest of shareholders, and that they do not necessarily lead to the best utilization of assets within an industry. These theories arose in an attempt to explain some other well known facts about merger waves. In particular, it has been well documented in past empirical studies that high M/B, P/E, and generally high stock prices have coincided with high merger activity (Harford (2005), Gugler, Mueller and Yurtoglu (2004), Globe and White (1988)),

One of the more popular theories, the overvaluation theory, argues that in times of high stock prices, many firms are overvalued which would explain their high M/B and P/E ratios.[8] The managers of these firms realize that their stock is overvalued and of course that this mistake will be corrected sometime in the future. In order to take advantage of that, they use their overvalued stock to acquire companies which are undervalued (or less overvalued than the acquirer). In this way the managers insure that their high stock price stays permanently that way. Some supporting evidence of this is found by Ang and Cheng (2006), who observe that the long run returns of stock financed acquirers are higher than those of similarly over-valued non-acquirers. The obvious question arises why managers of the target firm would accept stock if they know that it is very likely to be overvalued. One explanation is that managers of the target firm have shorter time horizons (Schliefer and Vishny (2003)). If the target managers accept the acquirer's overvalued stock as payment, and immediately sell the stock, they receive the full value of their firm plus a substantial premium without having to worry about the overvaluation of the stock. Another model is proposed by Rhodes-Kropf and Viswanathan (2004) in which the

[8] In most of the literature mentioned in this section, M/B is used as the proxy for misevaluation as it is a much more accurate measure of misevaluation than P/E. See Fama and French (1996) and Dong et al. (2005)

target overestimates the acquirer's value (and synergy) in times when market is overvalued and underestimates it in times when market is undervalued. On average the target managers estimate the correct value, but the higher the misevaluation in the market the higher the error of their estimate. As a result, there are more stock-financed mergers in periods when the market is overvalued and more cash-financed mergers when the market is undervalued. In fact, many studies have confirmed these results. Ang and Cheng (2006), Dong et al. (2005) and Rhodes-Kropf, Robinson and Viswanathan (2005) all find that stock acquirers are more overvalued than cash acquirers, and stock-acquired targets are more overvalued than cash-acquired targets in periods of high market valuation. Furthermore, Loughran and Vijh (1997) show that the capital market is aware of this phenomenon: after the announcement, acquirers using stock to finance the merger experience negative long run abnormal returns, while acquirers who use cash experience positive long run abnormal returns (Rhodes-Kropf and Viswanathan (2004)). Rau and Vermaelen (1998) find that in general overvalued acquirers perform worse regardless of the way mergers are financed.[9]

Even though this theory differs from the neoclassical theories in that the capital market efficiency assumption is omitted, the assumption that managers work in the best interest of shareholders and are wealth maximizing is still in place. Many other theories in this group omit this assumption, for example Morck, Schleifer and Vishny (1990) provide evidence that acquirers experience negative returns when the managers pursue their own objectives rather than maximizing the wealth of their shareholders. Gorton, Kahl and Rosen (2005) propose a theory

[9] Their findings suggest that acquirers who are considered growth firms (high M/B ratio) have negative long run abnormal returns (-17.3%) while value firm acquirers (low M/B ratio) have positive abnormal returns (7.6%) over the period 1980-1991.

of defensive mergers, in which managers participate in unprofitable mergers in order to prevent from being acquired by other firms.[10]

Some researchers have directly compared the ability of the two theories to predict aggregate merger patterns, however they obtain mixed results. Generally, the studies state the often conflicting hypotheses of each theory and then test them empirically. Harford (2005) finds that overvaluation variables explain very little data on their own, while shocks (together with sufficient aggregate capital liquidity) can explain a large amount of the merger data.[11] Gugler, Mueller and Yurtoglu (2004) on the other hand find that behavioral hypotheses, in particular the managerial discretion hypothesis, can best explain aggregate merger waves.

Over the last two decades, it seems that both sets of theories played a significant role in aggregate mergers. The neoclassical theories were dominant in the 1980's, while in the 1990's, especially during the tech bubble late in the decade, it was the behavioral theories that dominated. Dong et al. (2005) compare the q-theory to the misevaluation theory for a period 1978-2000. They find evidence supporting the q-theory of mergers in the period 1978-1990, while in the 1990-2000 period misevaluation theory was definitely more dominant. Andrade, Mitchell and Stafford (2001) find supporting evidence for this: most of the mergers in the 1990's were financed by acquirer's stock (about 70%), while in the 1980's it was cash (leveraged buyout), and only about 20% of mergers involved any stock financing. This would suggest that overvaluation played a smaller role in motivation for mergers in the 1980's. And finally, during the 1980's merger wave, the stock market valuation was much lower than in the 1960's and 1990's (Schleifer and Vishny (2003)).

[10] Goriatchev (2006) finds some empirical evidence supporting this theory, although many results remain inconclusive

[11] Harford (2005) finds that neoclassical theory can better explain the cause of industry/aggregate merger wave, amount of cash and partial-firm acquisitions and post-merger operating performance of firms

CHAPTER 3
HYPOTHESES

By examining the effect of the business cycle on industry-level mergers, we attempt to answer 3 unique questions. 1. Does a pro-cyclical pattern for aggregate industry mergers still exist after we control for other macroeconomic and industry-level variables? 2. How do the results differ between horizontal and non-horizontal mergers[12]? 3. Do merger determinants and financing preferences change in different stages of the business cycle?

1. Pro-cyclicality of mergers

The boom period of the business cycle is characterized by the steady expansion of the economy. Current economic activity is often an indicator of future aggregate demand, and as most industries begin to anticipate growing demand they will expand either through internal investment or mergers. Mergers are a very attractive form of investment during this period because they allow acquirers to increase output much faster than internal investment (Becketti, 1986). In addition, the financing conditions are quite favorable in this stage as inflationary pressures are relatively low and the financial markets are generally performing very well. As a result we expect a steadily increasing pattern in merger activity during this stage. Near the peak of the business cycle, growth in most industries is diminishing, and firms start to experience a decline in earnings, profits and employment. Since there is less need for additional capacity, the growth of aggregate merger activity will start to slow down. During the recession period, firms in most industries will experience decreasing demand for their products which will result in excess capacity (Jensen (1993)). At this stage, the majority of mergers will be undertaken to

[12] We classify horizontal mergers as those in which both the acquirer and target belong to the same industry. Non-horizontal mergers include both vertical and conglomerate mergers. See section 4.2 for more details on industry and merger type classifications.

reduce excess capacity. Maksimovic and Phillips (2001) observe that reallocation of assets due to merger is higher in expansion than in recession. The trough stage will again see a rise in expansionary mergers as policy induced interest rates and inflation fall and firms have a better outlook for future demand.

It is important to note that although we expect both horizontal and non-horizontal mergers to be pro-cyclical, the driving force behind each type of merger is quite different. This will be discussed in more detail in the next section. Above we have described the pro-cyclicality of aggregate demand, which is one of the primary motivations behind horizontal merger activity. Horizontal mergers are in a large part used to increase or decrease the firm's capacity, and are therefore highly sensitive to industry performance and shifts in aggregate demand (Andrade and Stafford, 2004). As we will see from the next section, the pro-cyclicality of acquirers' financial constraints plays a larger role in explaining the pro-cyclicality of non-horizontal mergers. When firms are less financially constrained they can explore economies of scope (Maloney and McCormick, 1988). These arguments lead us to two hypotheses:

Hypothesis 1.a: *Aggregate industry mergers, both horizontal and non-horizontal, are pro-cyclical: reaching the highest levels at the end of the boom period, and decreasing in value during the recession stages.*

Hypothesis 1.b: *The probability of both types of mergers occurring within an industry is pro-cyclical. The likelihood of observing mergers within a particular industry will be higher during expansion and peak periods than during the recession and trough periods.*

2. Determinants of horizontal/non-horizontal merger activity

There are a number of other factors are expected to influence merger activity, in addition to the business cycle. The neo-classical theories argue that the primary role for mergers is to increase asset utilization and overall efficiency within an industry. The motivations associated with this theory range from industry-specific shocks, which require large-scale asset allocation

within the industry, to firm-specific discrepancies in management performance, where the target firm's ROA and Tobin's Q ratios are significantly lower than the acquirer's. We hypothesize that these motivations will primarily affect the horizontal merger set.

Neoclassical theories and especially industry shock hypothesis have very few explanations for inter-industry mergers. The objectives of increasing asset utilization through means such as economies of scale and improving cost efficiency are usually not valid in these cases.[13] Inter-industry mergers would occur only in certain conditions, such as when the acquirer industry contains a small number of firms and potential targets are limited. However the behavioral theories do not differentiate between horizontal and non-horizontal mergers. For example, the only argument in the overvaluation hypothesis is that the acquirer is overvalued relative to the target, placing no assumption on the industry of either firm. Therefore overvaluation measures, such as the B/M ratio, are expected to affect both types of mergers but will have much more explanatory power for inter-industry mergers than for horizontal mergers.

Hypothesis 2.a: *Although financial constraints and overvaluation play a role in horizontal mergers, they are heavily affected by economic conditions, and are used to increase/decrease capacity, in line with neo-classical theory of mergers.*

Hypothesis 2.b: *Non-horizontal mergers are less affected by neo-classical factors and economic conditions, and more by financial constraints (e.g. capital market conditions and overvaluation), in line with behavioral theories of mergers.*

3. Merger determinants across business cycle stages

Previous studies have reported industry performance, interest rates and stock prices to have a significant impact on aggregate mergers. However, the impact of each variable, as well as the general level of mergers, may differ across the business cycle stages. Interest rates and performance measures are expected to play a larger role in the trough and boom periods, because

[13] Note that inter-industry mergers include vertical mergers. Vertical mergers can of course be used to attain these goals, but because they account for only a fraction of all non-horizontal mergers, their effect will be very diluted.

the general level of interest rates will be fairly low during these stages. On the other hand the stock prices and over-valuation measures will be relatively more important at the peak of the business cycle, because during this stage, investor optimism and stock overvaluation are generally at their highest levels. Finally, we expect horizontal mergers to serve an expansionary role during the growth stages of the business cycle, and a contractionary role during the recession period.

Hypothesis 3: *Merger determinants will have varying effects across the business cycle stages. Interest rates and the economic conditions should play a larger role in the trough and boom periods, while the stock prices and B/M ratio will be relatively more important in the peak period.*

CHAPTER 4
VARIABLE DESCRIPTION, DATA AND METHODOLOGY

This chapter gives a general description of the relevant variables, the data and sample construction as well as the methodology used in the study. Section 4.1 outlines the basic model and gives a brief description of the variables. Section 4.2 describes the data, sample construction, and potential problems associated with the data. Section 4.3 discusses the methodology.

4.1 Variable Description

Our main model, presented below, tests the impact of the business cycle on industry mergers, after controlling for other factors found in the existing literature.

$$Merger\ Activity = f(BC, Other\ Macroeconomic\ Variables, Industry\ Specific\ Variables) \quad \textbf{(1)}$$

Merger activity is defined as the total transaction value of mergers divided by the total assets in a particular industry. It is a function of three groups of variables: the business cycle (BC), macroeconomic variables and industry-level variables. Apart from the business cycle, other macroeconomic variables include stock market returns and interest rates. Industry-level variables are divided among neoclassical, overvaluation, and 'other' groups.

Macro-economic variables

The two main macroeconomic variables are interest rates and market returns. We use one year effective yield of the 10-year Treasury Bonds as the proxy for the interest rate (I_t) and one year holding period returns of the S&P 500 Index as the proxy of market returns (S_t). Because most mergers are financed with a combination of debt and stocks, these variables also represent the transaction environment for mergers.

Neoclassical variables

We use the Harford (2005) definition of industry shocks. Namely, we estimate the first principal component of various industry-level variables as a proxy for the industry shock. The variables used in the estimation include sales growth, asset turnover, employee growth, R&D expense, profitability (defined as Net Income divided by sales), ROA and capital expenditures.

In addition to the broad industry shock variable, we use a regulatory shock proxy. Following Mitchell and Mulherin (1996) and Harford (2005), we create a dummy variable which

equals 1 in the year of deregulation, as well as the subsequent year, and zero otherwise. Using the deregulation events from Harford (2005), the sample period contains 15 deregulation events in 5 different industries.

Overvaluation variables

Creating an accurate proxy for firm overvaluation is very difficult in general. As Gugler, Mueller, and Yurtoglu (2004) note, if researchers were able to accurately identify overvalued firms, then so would the capital markets, and the firms in question would no longer be overvalued. Nonetheless, overvaluation measures are widely used in this line of research as determinants of merger waves. We use two different industry-level overvaluation measures: the standard deviation of the weighted average industry Tobin's Q ratio, and the weighted average B/M ratio. The standard deviation of Tobin's Q is an important determinant of overvaluation-motivated mergers within an industry. A higher dispersion of Tobin's Q across firms will result in higher potential benefits of acquisitions between high Q acquirers and low Q targets. Since it only captures dispersion within an industry, it is expected to positively affect horizontal mergers only, while it may either not affect or negatively affect non-horizontal mergers. The negative relationship might occur in industries with relatively low dispersion of Tobin Q ratios: firms will have fewer profitable merger opportunities within their own industry and will therefore be more likely to look for mergers outside their industry.

At firm level, B/M is not a meaningful overvaluation variable because many factors, such as intangible assets and goodwill, can increase the market value of a firm; thus giving it a permanently low B/M ratio without actually being overvalued. However at industry level, it is quite reasonable to assume that these effects cancel out and low B/M ratios are caused by industry-wide overvaluation. The B/M ratio is expected to have a significant negative

relationship with mergers, particularly non-horizontal mergers, where firms from low B/M industries acquire targets from high B/M industries.

Other Industry-specific variables

Assets

The general level of merger activity within industries is expected to vary by assets size (firm size), and cash reserves. Asset size is expected to have a positive effect on both types of mergers. Larger corporations can usually raise funds easier, and at lower rates than smaller firms (Petersen and Rajan (1992), Fazzari, Hubbard and Petersen (1988)). This would result in more investment opportunities, including mergers.

Cash and excess cash

Firms with high cash reserves are less reliant on externally generated funds and will have more investment opportunities at their disposal, particularly in times of high inflation and interest rates (see for example Lamont (1997)). There are also agency cost issues involved, for example Jensen (1986) and Harford (1999) argue that managers are more likely to over invest in (not necessarily value creating) capital projects and acquisitions, the more cash they have at their disposal. Average cash reserves are therefore also expected to be positively related to mergers. To control for the varying industry characteristics which determine normal cash reserve requirements, we create a second variable, excess cash, which is simply the cash level in industry *i* and time *t*, minus the historical average of cash levels in industry *i*.

D/E ratio

Similar to the cash level, the D/E ratio can also be considered a financing constraint variable. In the static tradeoff theory, firms with a high level of debt face a higher cost of issuing debt (through increased cost of equity (Modigliani and Miller (1963)), and thus have fewer

opportunities to finance their acquisitions. We therefore expect to see a negative relationship between average industry D/E ratios and both types of merger activity.

Acquirers also often use mergers to adjust their financial structure, in particular they use mergers to increase their D/E ratios. Bruner (1988) and Gugler and Konrad (2002) find that firms involved in mergers have different financial structures than non-merging firms. More specifically, the D/E ratios of acquiring firms are significantly lower relative to both non-merging and target firms. After the merger, the leverage of the acquirer rises significantly higher relative to non-merging firms.

Industry concentration

The industry concentration variable captures merger motivations related to the industrial organization theory. For example, the defensive mergers proposed by Gorton, Kahl and Rosen (2005) fall into this category. We expect to see a negative relationship between merger activity and industry concentration. First, the profitability of large firms in a highly concentrated industry is going to be higher than for small firms in less concentrated industries. Therefore firms in less concentrated industries have a greater incentive to merge to gain a higher market share and ultimately higher profitability. Also it could be the case that there are simply more potential targets in a less concentrated industry.

Capacity utilization

Capacity utilization is an important merger determinant because it is a very good indicator of current economic conditions within an *industry*. It can have either a negative or positive relationship with merger activity, depending on whether mergers are motivated by expansionary or contractionary forces. Andrade and Stafford (2004) find a negative relationship between capacity utilization and industry level mergers.

4.2 Description of the Data

Industry classification

Dividing firms into very few industries could lead to diluted results because many "true industries" will be bundled into one. On the other hand, having too many will increase the risk of breaking "true industries" into two, producing biased results as well as sparser data. It can be very hard to put a clear line between two industries, especially for large firms that are vertically integrated and have significant revenue from more than one industry. We use the Fama and French (1997) SIC code classification in this study.[14] Following the methodology of many previous industry-level studies, such as Ang and Cheng (2006) and Harford (2005), we use the 48 industry classification.[15]

M&A Data

We collect M&A data from the *Thompson Financial's SDC Platinum* Database. It contains all mergers and acquisitions between U.S. firms from 1979 to 2006. We require that i) an observation is not classified as spin-offs, self-tenders, exchange offers, repurchases, minority stake purchases, and privatizations, ii) each observation must have a target and acquirer CUSIP, SIC code, and a completion date. These filters return an initial sample of 102,622 mergers and acquisitions.

We divide all targets and acquirers into 48 industry groups, based on Fama and French (1997) industry classifications. The dataset is then divided into two groups; observations for which the target and acquirer have identical industry codes (horizontal or related mergers) and

[14] The classifications can be found on Kenneth French's website:
http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html
[15] Tables B and C in the Appendix show industry classifications in more detail.

others (non-horizontal or diversifying).[16] For each observation, the announcement month is considered to be the time when the merger occurs.[17] All firms in financial and undefined (Fama-French 44-48) industry groups are removed from the sample. The resulting horizontal merger set contains 42,323 observations and the non-horizontal set contains 25, 918 observations.

Following the methodology of Moeller, Schlingeman and Stulz (2002), we exclude all observations where the acquirer is a private firm, while the target firms can be both private and public. This reduces the sample size in the horizontal set from 42,323 to 23,988 observations, and in the inter-industry set from 25,918 to 18,024 observations.[18]

Next, we calculate the total monthly transaction values of the two datasets. For the horizontal mergers, all transaction values within a month are summed for each industry. The resulting table has 43 industries and 332 months. For non-horizontal mergers, the transaction value is assigned to the acquirer industry, and all values within a month are summed up. Our non-horizontal merger activity variable therefore measures amount of assets acquired by an industry through mergers, but does not measure the amount of assets lost to other industries.

We standardize industry level monthly mergers by scaling total monthly transaction values by monthly industry level total asset value. Scaling factors for non-horizontal mergers are based on those of acquirer's industry. Industry level aggregate data is based on public firms represented in Compustat.

In both datasets, there are two potential issues. First, there are a large number of observations where no mergers take place. Figure 4.1 provides the distribution of percentages of

[16] This is the only segregation of mergers in this study. Separation of hostile and friendly mergers, as done by Morck et al. (1988) and Mitchell and Mulherin (1996) among others, is left out in this paper. This can be justified by a few recent studies, particularly Schwert (2000), who finds no difference between hostile and friendly mergers in terms of their accounting and stock performance data.

[17] Firms generally take many months of planning before announcing a merger, and it usually takes 6-8 months to complete the deal. If such a long process is to be pinned down to one point in time, the best place would be the announcement date, since managers will make the announcement when it is most profitable to have the merger.

[18] The rationale for this filter is given later in this section.

non-active months (months in which no mergers take place) across industries. In any given industry there are at least 20% of the months where no mergers take place. In most industries, there is no merger activity for the majority of the months in the sample.

Figure 4.1: Percentage of Non-active Months by Industry

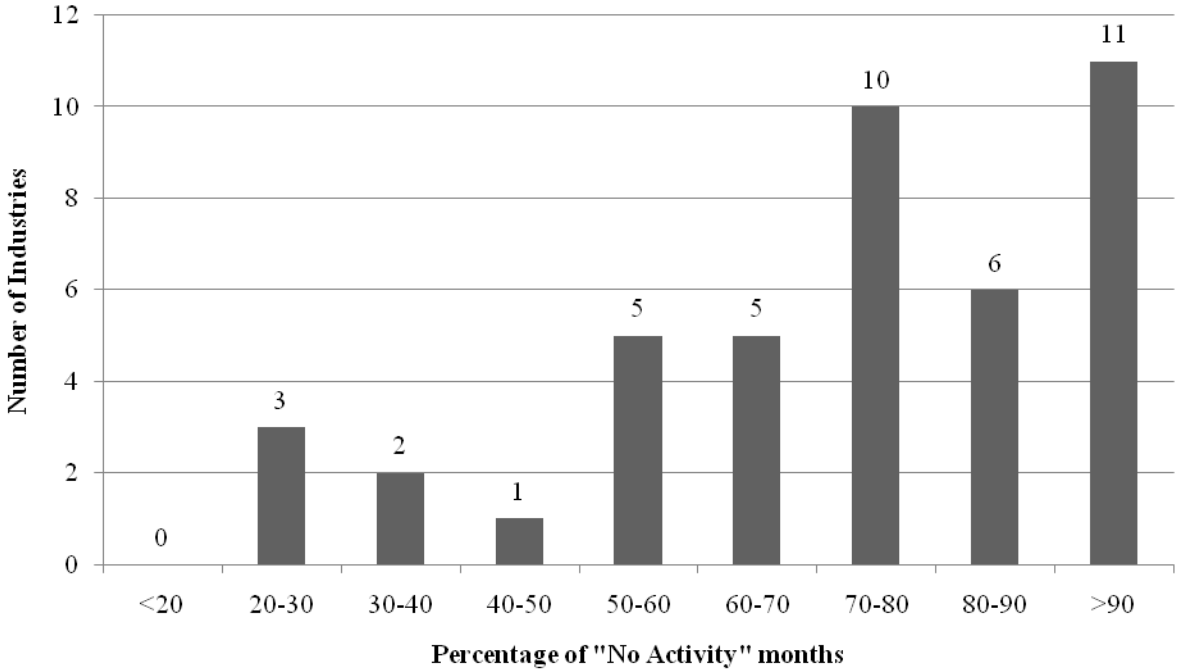

Figure 4.1 presents the distribution of non active months across industries. Within our sample period, only 3 industries have had merger activity in more than 70% of the months (i.e. in more than 232 different months). On the other hand, 11 industries have had mergers in less than 32 different months (less than 10% of the months in the sample period).

Some industries in general have a higher concentration of mergers, which explains the uneven distribution in Figure 4.1. Furthermore, the number of mergers is steadily increasing over the sample period. This results in the number of "inactive" industries decreasing over time (as seen in Figure 4.2). This sparse data problem is faced in many studies that examine merger activity at the industry level (e.g. Mitchell and Mulherin (1996), Harford (2005) and Andrade and Stafford (2004)). We follow the Andrade and Stafford (2004) approach by fitting Tobit specifications and treating the data as being censored at zero.

Figure 4.2: Fraction of Inactive Industries over Time

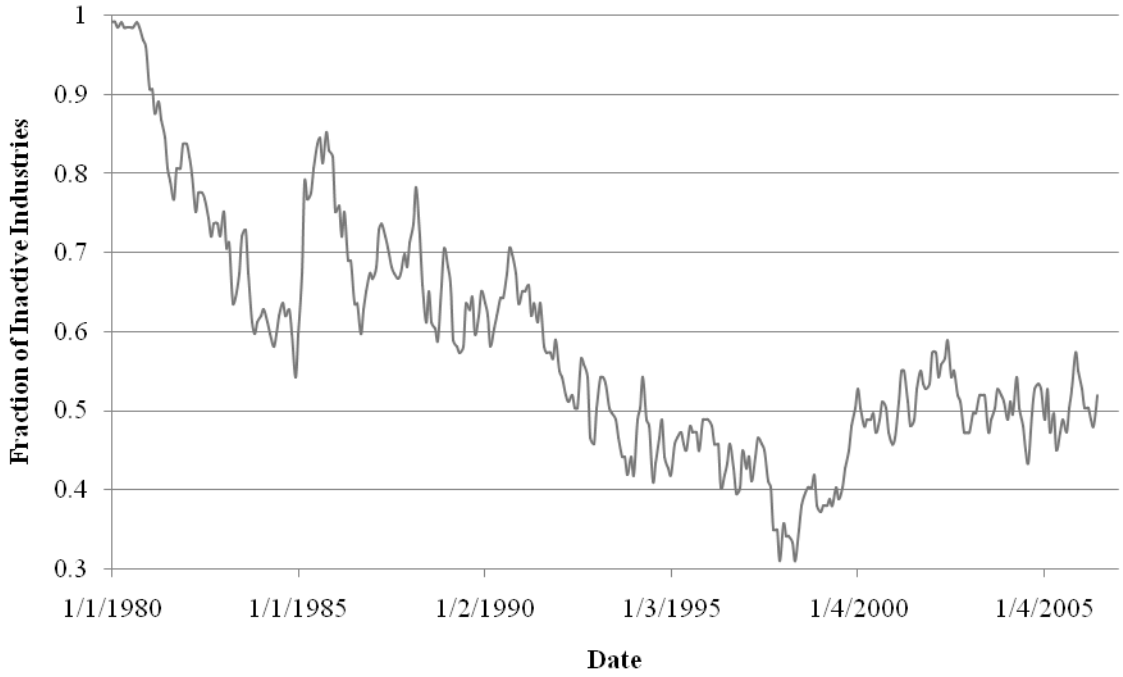

Figure 4.2 presents the fraction of "No Activity" industries in each month of the sample period. There is a general downward trend over time. The highest number of inactive industries is found at the beginning of the sample period, when SDC data was not as comprehensive. The lowest number of inactive industries occurred in 1998 during the last merger boom.

The second problem is that the M&A data contain all U.S. mergers, regardless of size and public status. As a result, many observations are mergers between two private firms. Table 4.1 provides the breakdown on the public status of acquirers and targets and the number of mergers for each combination.

Table 4.1: Public status of Targets and Acquirers

HORIZONTAL MERGERS			NON-HORIZONTAL MERGERS		
Acquirer	**Target**	**Number**	**Acquirer**	**Target**	**Number**
Public	Public	1699	Public	Public	1174
Public	Private	14755	Public	Private	11506
Public	Other*	7534	Public	Other*	5344
Private	Public	252	Private	Public	211
Private	Private	6440	Private	Private	2228
Private	Other*	5093	Private	Other*	2099
Other*	All Types	6550	Other*	All Types	3356
Total Mergers		42323	Total Mergers		25918

Table 4.1 presents the number of observations for each type of merger depending on the public status of targets and acquirers. In both horizontal and non-horizontal mergers, the most common type of merger is between a public acquirer and private target.

* "Other" includes joint ventures, government-owned corporations, subsidiaries, mutually owned firms, and firms whose status is unknown. 'All Types' refers to all public status types, including public and private.

A number of problems arise if private mergers are included in the sample. First, we compute industry-level variables using Compustat, which only includes public firms listed on major U.S. stock exchanges. This provides an estimate of industry characteristics of public firms only, since one cannot assume that on average private and public firms have similar characteristics.[19] Also, merger values are scaled by total assets in an industry, and we estimate total assets using public firms only. We cannot include private mergers in the sample, because we cannot account for the assets size of the private firms.

Compustat Data

Industry level aggregate data is based on public firms represented in Compustat. Table 4.2 provides the list of the variables and the constraints for each variable. Variable definitions and constraints for Cash flow, Sales Growth, and Tobin's Q are taken from Andrade and Stafford (2004) definitions.

[19] See Osteryoung, Constand and Nast (1992) for comparisons of financial ratios between public and private firms.

Table 4.2: Definition of Firm Specific Variables

Variable	Definition	Constraint
Assets	Current assets + net property, plant and equipments + other non-current assets	Assets > 0
D/E ratio	[Total debt / shareholder's equity] × 100	D/E > 0
Cash	Includes cash and equivalents	Cash > 0
B/M ratio	[Common shares outstanding × book value per share] / market value per share	B/M > 0; B/M < 100
Tobin's Q	[book value of assets + market value of equity-book value of equity] / book value of assets	Assets > 0; Market and Book Equity > 0
Asset Turnover	Net $Sales_t$ / [(Total $Assets_t$ + Total $Assets_{t-1}$) / 2]	Asset Turnover > 0
Capital Expenditure	Expenditures for capital leases + increase in funds for construction + reclassification of inventory to property, plant and equipment	Cap. Exp. > 0
Employee growth	Change in number of employees in period *t*/number of employees at period *t-1*	
Profitability	Net Income / Sales	Sales > 0
R&D	Total annual R&D costs	R&D > 0
ROA	Income before extraordinary items / Total Assets	
Sales growth	[$Sales_t$ / CPI_t] / [$Sales_{t-1}$ / CPI_{t-1}] -1	Sales (t and t-1) > 0

Table 4.2 presents the variable definitions and the criteria for inclusion into the dataset. All variables are obtained from the Compustat database.

Similar to Fama and French (1992), all Compustat variables from fiscal year-ends in t-1 are matched with the SDC and CFNAI data for July in year t to June in year t+1. The minimum 6 month lag takes into account approximate time between the fiscal yearend and the time by which annual reports are publicly available and information is incorporated in pricing firm's securities.

Aggregate and industry-level capacity utilization rates are obtained from the Federal Reserve Bank of St. Louis' FRED database.[20] Although the industries are classified in a different manner, a range of SIC codes is reported for every industry, which makes it relatively simple to rearrange the data into industries as defined in this study. In some cases, the industries are somewhat broadly defined and cover more than one Fama and French (1997) classification. In that case, all the covered industries are given the same values (similar to Andrade and Stafford (2004)).

SIC classifications can vary significantly over various databases. Kahle and Walking (1996) find that 36 percent of Companies listed in both CRSP and Compustat do not match at the 2 digit level. Assigning the primary SIC code to a firm can be difficult, especially for large firms that generate a significant amount of revenue in more than one industry. Because each database has its own (sometimes very different) classification method, codes from all sources are converted to the Compustat classification.

[20] http://research.stlouisfed.org/fred2/

Business cycle definition

We capture the monthly aggregate economic activity using an index developed by Stock and Watson (1999) and maintained by the Federal Reserve Bank of Chicago (also known as the Chicago Fed National Activity Index (CFNAI)). This index holds several advantages over the traditional proxies of economic activity used in the literature, for example, unemployment rate, GDP, GNP and industrial production index. First, it is derived from a wide range of monthly inflation adjusted economic indicators, broadly classified into five categories, to give the most objective measure of current economic activity: 21 series from output and income, 24 series from employment, unemployment and hours, 13 series from personal consumption, housing starts and sales, 11 series from manufacturing and trade sales, and 16 series from inventories and orders. The *CFNAI* index is a real-time measure of economic activity; as such it uses only economic data that is available at the time of estimation. By construction, the index has a mean of zero and standard deviation of one. A value of zero corresponds to an economic activity growing at trend, while negative and positive values correspond to economic activities growing at below and above trend, respectively. The fluctuations of CFNAI measure the deviation from the long run trend, therefore this paper examines growth business cycles as defined in Stock and Watson (1998).

A cyclical pattern associated with the business cycle is not immediately evident from the raw CFNAI series in Figure 4.3 (below). This is an indication of the presence of both regular cyclical and irregular non-cyclical components in the data. Presence of non-cyclical components is problematic. Moreover, even some cyclical patterns with frequencies significantly higher (e.g. seasonal fluctuations) or lower (e.g. long-term secular trend) than the range of frequencies that

define the business cycle could be problematic. We use a band-pass filter method as defined Baxter and King (1999) to deal with this problem.

The Baxter and King (1999) method, like the Hordrick and Prescott (1997) filter, is specifically designed for measuring business cycles.[21] The model breaks down the time series into 3 components: irregular components, business cycle components and trend. Business cycle components have an upper and lower bound of frequencies; any frequencies higher than the upper bound are irregular components, while any frequencies lower than the lower bound are long-term trends.

We use 36 months leads and lags to estimate the ideal filter, and assume the minimum and maximum length of the business cycle to be 18 and 96 months respectively, consistent with Burns and Mitchell (1946), Baxter and King (1999) and Christiano and Fitzgerald (2003).[22] Figure 4.3 shows the original data along with the filtered series. As can be seen from the frequency response function in Figure 4.4, only minor differences between the actual and ideal filter exist around the cutoff points (i.e. there is some leakage and compression at certain frequencies), suggesting that the estimated filter is a very close estimation of the ideal band pass filter.

[21] The Baxter and King (1999) method, however, holds an advantage over the Hodrick-Prescott (1997) (HP) filter for two reasons. First, because the HP filter only separates long term components from cyclical components, much of the high-frequency noise seeps into the business cycle estimation. Second, because monthly data is used in this study, it is very unclear which smoothing parameter (λ) should be used. The HP filter estimates the cyclical component using the following equation: $\min_{\{g_t\}} \left\{ \sum_{t=1}^{T} (y_t - g_t)^2 + \lambda \sum_{t=2}^{T-1} \left((g_{t+1} - g_t) - (g_t - g_{t-1}) \right)^2 \right\}$, where y is the unfiltered data and g is the long term trend component. For quarterly data, empirical studies have shown that λ=1600 is a reasonable approximation for the filter. However, it is unclear what values to use for data with frequency other than quarterly.

[22] Everts (2005) uses the Bry and Boschan (1971) procedure to estimate the maximum length of the business cycle at 126 months and argues that business cycles have increased in duration during the last century. However, changing the maximum duration from 96 to 126 months has very little impact on the filtered series for the sample period used in this paper.

There are a few potential problems with the Baxter and King (1999) filter, most notably it uses the same amount of lags and leads to derive the cyclical components. Using leads implies that we are using information that is not available at the time, which defies the use of a real time measure of economic activity. Therefore in addition to the above filter, we use simple 6 month and 1 year moving averages of the CFNAI to investigate the robustness of our findings. The moving averages are intuitive substitutes since a merger decision is a long process; in addition, it removes some of the irregular components by making the series smooth.

Figure 4.3: Fixed Length Symmetric (Baxter-King) Filter

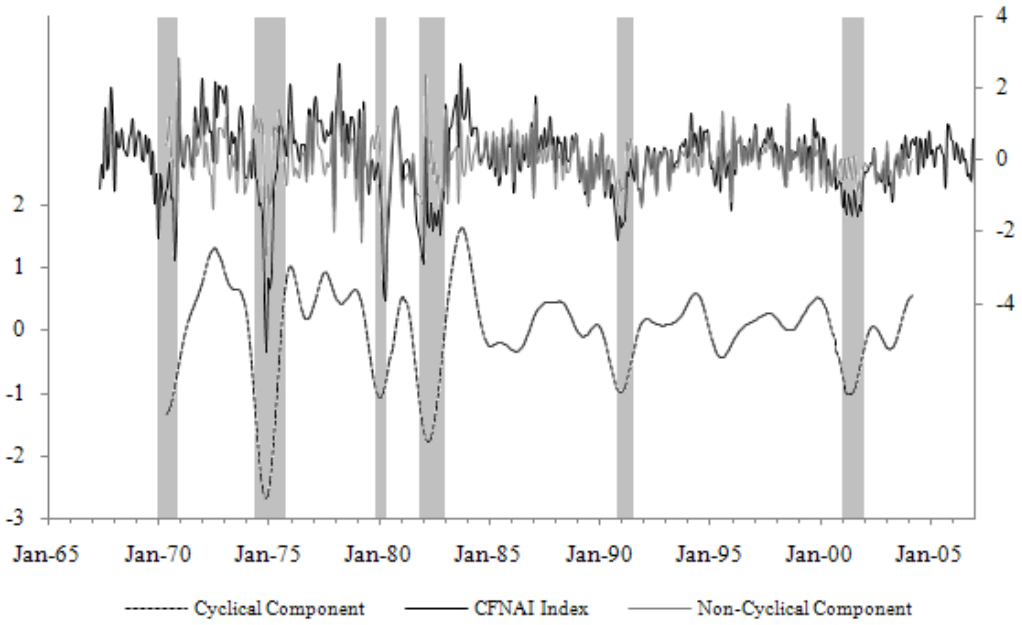

Figure 4.3 presents the original CFNAI index along with its cyclical and non-cyclical components. The shaded regions are recession periods as identified by National Bureau of Economic Research (NBER).

Figure 4.4: Frequency Response Function

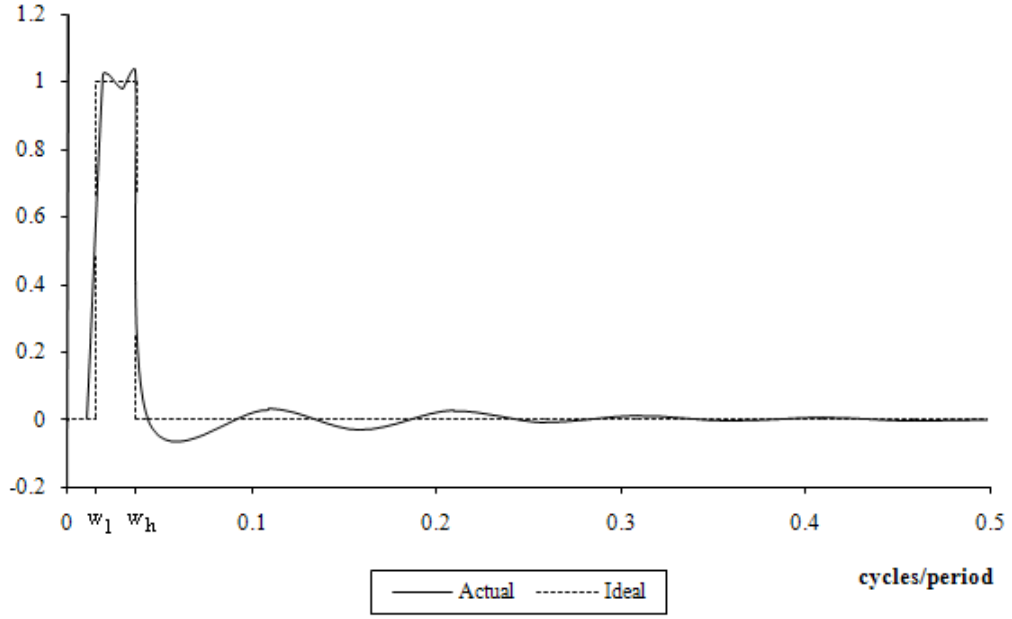

Figure 4.4 presents the frequency response function of the Baxter-King (1999) filter. The cyclical components with frequencies between w_l and w_h remain in our business cycle variable. Ideally, components between w_l and w_h will be completely unaltered, and therefore have a frequency response function of 1, while the remaining frequencies are removed (have a frequency response function of 0).

Following the framework of Mitchell (1927) and Mitchell and Burns (1946), the structure of the business cycle is divided into four distinct phases (or stages): prosperity (peak), crisis (recession), depression (trough) and revival (boom). Each of the phases evolves from one into the other in the above order. The following section describes how each stage is estimated.

Troughs:

To calculate the range of the trough stage, we assign all CFNAI index values less than the 15th percentile to this stage. Out of the 332 months in the sample period, 51 fall in the trough stage. Using this method, we identify four trough stages that existed during our sample period. The NBER also identifies four troughs during this period, which occur on July 1980, November 1982, March 1991, and November 2001. Our estimated dates fit very well with the NBER dates: each month identified by NBER as a trough date is also identified as part of our trough stage.

Peaks:

Because the business cycle peaks are not so easy to identify, each one is examined individually. In general there are at least 3 potential peaks in each cycle, and the one closest to the NBER definition is taken as the true peak of the cycle. The first and the last peak in our data sample occurred on January 1980 and March 2001, respectively. Both of these dates are about 12 months ahead of our estimated peaks. The second and third peak occurred on July 1981, and July 1990, respectively. Both dates coincide almost perfectly with the estimated peaks.

Rest of the Cycle:

The business cycle is broken down into four parts. The troughs have already been identified and their lengths have been determined by a formula (less than 15th percentile). The peak period is then designed to have a similar length as the trough period in each cycle. Any

values between the peak and the trough periods are assigned as recession and between trough and peak as boom periods.

4.3 Methodology

4.3.1 Test for pro-cyclicality of mergers

We use two different regressions to test the first hypothesis in section 3. For hypothesis 1.a, we use a Tobit model to test the impact of the business cycle on industry mergers after controlling for other known factors found in the existing literature

$$y^*_{it} = \alpha_1 + BC_{t-1} + Other\ macroeconomic\ Variables_{t-1} + Industry\ specific\ Variables_{i,t-1} + \eta_i + \varepsilon_{it} \qquad \textbf{(4.2)}$$
$$i = 1,2,...N,\ t = 1,2,...T$$

Own-industry (Horizontal) and inter-industry (Non-Horizontal) mergers are examined separately, as the underlying motivation for the two groups might be significantly different. The dependent variable y^*_{it} is our merger activity variable, which is defined as the total transaction value of mergers (scaled by total assets) for industry *i* in period *t*.[23] BC_{t-1} is the business cycle proxy, our main variable of interest. The definitions of the control variables are given in section 4.1, they are classified into macroeconomic and industry specific groups. The macroeconomic variables include stock market returns and interest rates, while the industry-level variables are further divided among neoclassical, overvaluation, and 'other' groups. Lastly, η_i is the time-invariant and unobserved industry component, and ε_{it} is the classical disturbance term. The last

[23] As explained in section 4.2, Tobit specifications will be fitted to deal with the large number of zeros that would otherwise cause the OLS estimator to be inconsistent. Therefore the observable variable y_{it} is defined as

$$y_{it} = \begin{cases} y^*_{it} & if\ \ y^*_{it} > 0 \\ 0 & otherwise \end{cases}$$

two terms are part of the panel data models, which will be discussed in more detail in the next section.

We use a Logit model to test whether the probability that an industry undertakes a merger is pro-cyclical (hypothesis 1.b). The same explanatory variables are used as in equation 4.2, and horizontal and diversifying mergers are again estimated in separate regressions.

$$y_{it} = \alpha_1 + BC_{t-1} + Other\ macroeconomic\ Variables_{t-1} + Industry\ specific\ Variables_{i,t-1} + \eta_i + \varepsilon_{it} \qquad \textbf{(4.3)}$$
$$i = 1,2,...N,\ t = 1,2,...T$$

The dependent variable y_{it} is assigned a value of one if a merger occurs in industry *i* at time *t*, and zero otherwise. In both equations (4.2&4.3), our variable of interest is the business cycle. If our hypotheses are correct, we expect the coefficient of the business cycle to be positive and significant in both cases.

4.3.2 Determinants of industry-level merger activity

To test whether different factors drive horizontal and non-horizontal mergers, we use the same regression specified in equations 4.2 & 4.3. However for both the Tobit and Logit specifications, we run five additional models. We include the business cycle in all models. In the first model we include only macroeconomic variables, in the second and third model we include only neoclassical and overvaluation variables respectively, and in the fourth and fifth models we include other relevant industry-specific variables. Under this framework, we can not only test whether both types of mergers are affected by the same sets of variables, but also whether the business cycle has additional explanatory power after controlling for all of these factors.

4.3.3 Merger determinants across different business cycle stages

Finally to test hypothesis 3, we use a Tobit model with slope and intercept dummies for the business cycle stages.

$$y_{it}^{*} = \sum_{p=1}^{4} \alpha_p d_p + \sum_{p=1}^{4} \sum_{q=1}^{N} \beta_{q+(p-1)N} d_p x_{q,it} + \eta_i + \varepsilon_{it} \qquad \textbf{(4.4)}$$

The dependent variable y^{*}_{it} follows the same definition as in section 4.3.1. The dummy variable d_p equals one for all months which fall into a particular stage (p), and zero otherwise. The explanatory variables $x_{q,it}$ include all macroeconomic and industry-specific variables, other than the business cycle. In the above model we suppress the slope coefficients of each variable ($x_{q,it}$) and include the full set of interaction terms ($d_p x_{q,it}$). By using the full set of interaction terms in (4.4), the slope coefficients measure the full impact of the stage p on any given variable rather than the incremental impact relative to an omitted term.

4.3.4 Preliminary Specification tests

This subsection analyzes the statistical properties of the data in order to determine the most appropriate estimation approach. We test for the presence of random effects to justify using a panel data framework instead of a pooled OLS regression[24]. Next, we use the Hausman test to determine whether to determine the most appropriate type of panel data specification. Finally, we test for potential endogeneity problems between our macroeconomic variables.

[24] We thank Dr. Fan Yang for suggesting this test for random effects.

Test for random effects

This test examines whether there exist any industry effects (η_i) in our models. The null hypothesis is a pooled OLS model with all effects being equal. We test this using the Breusch and Pagan (1980) LM test for heteroscedasticity. Since the random effects model includes the industry effect in the error term, significant differences in the industry effects (heterogeneity) will induce heteroscedasticity. Rejecting the null hypothesis (no heteroscedasticity) means there is heterogeneity in the model and a pooled OLS regression is not appropriate.[25]

Hausman Specification Test

If the null hypothesis in the above test is rejected, and the panel data approach is justified, we run a Hausman specification test to determine the most appropriate type of panel data model. The variable η_i in equation (2) and (3) represents unobserved, time-invariant heterogeneity across industries, such as industry-specific antitrust environment, industry life-cycle stage, and investment opportunities. If these variables influence industry merger activity, omitting them will result in biased estimators (omitted variables bias) (Moulton 1986, 1987). Kleinert and Klodt (2002), for example, find that deregulated industries face very different conditions than former state monopolies, and as a result have very distinct motivations and merger patterns.

The two general approaches to panel data models consider the heterogeneity as either part of the individual-specific intercept (Fixed Effects model) or part of the error term (Random Effects model). Fixed Effects (FE) models directly account for the industry effects by either using dummy variables (Least Squares Dummy Variable model), or eliminating the time-invariant effects by subtracting the mean of each variable and each individual (within-group

[25] Alternatively, we could test the fixed effects model against a pooled OLS. This can be done by running an F-test where the pooled OLS is the restricted model with only one intercept, while the fixed effects model is unrestricted with *N-1* intercepts (where N is the number of cross-sectional units).

model).[26] On the other hand Random Effects (RE) models treat industry effects as part of the error term, whereby the model is estimated by first evaluating the variance structure of that error term and the generalized least squares estimator is used to estimate the parameters.

One crucial difference between the models is that the Random Effects models require one extra orthogonality assumption. The term η_i is assumed to be uncorrelated with the explanatory variables. The Hausman specification test examines if this assumption is valid. Therefore the null hypothesis is that η_i and all explanatory variables are uncorrelated. Under the null hypothesis both FE and RE estimators are consistent (although only RE is efficient), and therefore the RE model is preferred. If the null hypothesis is rejected, the FE estimator is consistent but the RE estimator is not. In that case a FE model should be used.

Endogeneity test

Regardless of which of the above models is selected (RE or FE), all explanatory variables are implicitly assumed to be exogenous. If this assumption is incorrect, then neither the RE nor the FE model will be consistent or unbiased, and a 2SLS model will have to be used. To examine the potential endogeneity problem, the Davidson-MacKinnon test is used.[27] Under the null hypothesis the RE or FE model will be consistent and efficient, while in the presence of endogeneity only the 2SLS (either RE or FE) models will be consistent.

Two variables in particular are suspected to be endogenous: interest rates and market returns. A large portion of mergers are at least partially financed by debt, and some researchers argue that aggregate merger activity can put a lot of pressure on money demand (Becketti

[26] The within-group model uses a transformation for dependent and explanatory variables before estimating the parameters: $\ddot{y}_{it} = \beta_1 \ddot{x}_{it} + \ddot{\varepsilon}_{it}$ where $\ddot{y}_{it} = y_{it} - \bar{y}_i$, $\ddot{x}_{it} = x_{it} - \bar{x}_i$, etc. The transformation eliminates the intercept and all other time-invariant variables.

[27] This test is used as an alternative to the Hausman test. Sometimes the difference of the covariance matrices between the RE and FE models is not positive definite, which was the case here. This leads to the Hausman test yielding meaningless test statistics (negative χ^2). The Davidson-MacKinnon test avoids this problem.

(1986)). The financing of mergers during merger booms could therefore have a significant effect on interest rates. Stock market returns could also be a function of aggregate merger activity. Andrade, Mitchell and Stafford (2001) among many others, find that the market reaction to merger announcements is positive for the combined firms, and on average stays positive until the transaction is complete. Many other studies have specifically argued that merger activity and stock market performance in general should be mutually reinforcing (For example Geroski (1984) and Globe and White (1988)).

CHAPTER 5
ANALYSIS OF RESULTS

This Chapter presents the regression analysis and empirical findings, for both horizontal and conglomerate merger activity. Section 5.1 reports the descriptive statistics of the test and control variables. Section 5.2 presents the results of the preliminary tests and determines the type of econometric model to be used. Finally, Section 5.3 presents tests of the effect of the business cycle on aggregate mergers, determinants of mergers and merger waves, and the characteristics of acquirers in different business cycle stages.

5.1 Descriptive Statistics

Panel A of Table 5.1.1 presents the descriptive statistics of the merger activity variables. The measure of monthly merger activity is the total monthly transaction values scaled by year-end industry book values of assets, which is then divided into horizontal and non-horizontal (diversifying) mergers. The table presents the number of observations, mean, standard deviation, range, and quartiles. The average horizontal merger activity is higher than the average non-horizontal merger activity in all stages. Using a t-test with unequal variances, we compare the two means in each stage and find that the average monthly horizontal merger activity is significantly higher than non-horizontal activity in both boom and peak periods at 5% significance level. However the means are not significantly different in the recession and trough periods.[28] Horizontal mergers exhibit a pro-cyclical pattern: average merger activity is highest at the peak of the business cycle and lowest in the trough, in line with our first hypothesis.

Panel B of Table 5.1.1 summarizes the explanatory variables. The statistics are given for the entire sample period, as well as for the business cycle stage sub-periods. A total of 3 macro-economic and 10 industry-specific variables are used in this study. The macro-economic variables (business cycle, interest rates and market returns) contain 332 monthly observations, while industry specific control variables contain up to 14276 observations (number of industry-months). The value of the business cycle variable ranges from -2.013 to 1.641, with a mean of -0.062, suggesting that the economic activity was growing below the long-term trend during the sample period. Interest rates and market returns are given as a 1 year effective annual yields/returns. Interest rates range from 0.0394 to 0.1424 (3.94%-14.24% per year) over the

[28] The results of the t-tests are not included in Table 5.1.1.

sample period. Market returns are more volatile during this period and annual returns range from -27.53% to 53.37%.

For each industry-level variable, the difference between the entire sample's mean and each sub-period's mean is given, along with the statistical significance (under the null hypothesis that the two means are equal). Several industry performance variables, such as employee and sales growth present a clear pro-cyclical pattern in which the recession and trough means are significantly less than peak mean.

Table 5.1.1: Descriptive Statistics of Regression Variables

Panel A: Dependent Variable Statistics

Type of Merger		All Stages	Peak	Recession	Trough	Boom
Horizontal	N	5746	917	762	734	3333
	Mean	0.0030	0.0038	0.0036	0.0020	0.0029
	Std.Dev	0.0108	0.0118	0.0135	0.0069	0.0105
	Min	0.0000	0.0000	0.0000	0.0000	0.0000
	Q1	0.0001	0.0001	0.0001	0.0001	0.0001
	Median	0.0005	0.0007	0.0004	0.0004	0.0005
	Q3	0.0018	0.0025	0.0019	0.0013	0.0018
	Max	0.1956	0.1450	0.1857	0.1211	0.1956
Non-horizontal	N	5635	899	707	740	3289
	Mean	0.0024	0.0025	0.0030	0.0023	0.0022
	Std.Dev	0.0125	0.0099	0.0170	0.0152	0.0112
	Min	0.0000	0.0000	0.0000	0.0000	0.0000
	Q1	0.0001	0.0001	0.0001	0.0001	0.0001
	Median	0.0003	0.0004	0.0003	0.0002	0.0003
	Q3	0.0012	0.0015	0.0012	0.0008	0.0011
	Max	0.2980	0.1676	0.2843	0.2980	0.2955

Panel A presents the descriptive statistics of the two merger activity variables during the sample period 1979-2006, consisting of a total of 14276 industry-months. The statistics are given for the entire sample period, as well as for the business cycle stage sub-periods. For horizontal mergers, each observation is calculated by adding the transaction values of all mergers and acquisitions within a month for each industry. The same process is followed for non-horizontal mergers, except that the transaction values are attributed to the acquirer industry only. Final scaled values are calculated for each industry as the ratio of total transaction values in a month to the industry's total book value at year-end.

Table 5.1.1 (Continued): Descriptive Statistics of Regression Variables

Panel B: Regressor Statistics

Variable		All Stages	Peak	Recession	Trough	Boom
Business cycle	N	14276	2150	2236	2193	7697
	Mean	-0.0616	0.3329	-0.1100	-1.2007	0.1667
			0.3945***	-0.0484***	-1.1391***	0.2283***
	Stdev	0.6570	0.2119	0.3890	0.4113	0.4794
	Min	-2.0128	-0.0550	-1.2180	-2.0128	-1.2871
	Max	1.6411	0.8581	0.4976	-0.4823	1.6411
Interest Rates	N	13803	1978	1935	2193	7697
	Mean	0.0777	0.0660	0.0776	0.0900	0.0772
			-0.0116***	-0.0001	0.0123***	-0.0004
	Stdev	0.0275	0.0221	0.0228	0.0314	0.0273
	Min	0.0394	0.0422	0.0436	0.0506	0.0394
	Max	0.1424	0.1159	0.1268	0.1424	0.1387
Market Return	N	14276	2150	2236	2193	7697
	Mean	0.1095	0.1196	0.1302	-0.0382	0.1428
			0.0101**	0.0207***	-0.1478***	0.0332***
	Stdev	0.1562	0.1423	0.0966	0.1362	0.1553
	Min	-0.2753	-0.2070	-0.1551	-0.2753	-0.2607
	Max	0.5337	0.4551	0.3793	0.2909	0.5337
Industry Shock	N	11726	1761	1646	1422	6897
	Mean	0.0000	0.2811	0.1551	0.2365	-0.1575
			0.2811***	0.1551***	0.2365***	-0.1575***
	Stdev	1.6251	1.7230	1.5016	2.0454	1.5069
	Min	-3.3097	-2.9456	-3.1547	-3.3097	-3.1793
	Max	12.5788	11.1688	11.1688	12.5788	12.5788
Deregulation	N	14276	2150	2236	2193	7697
	Mean	0.0252	0.0088	0.0134	0.0200	0.0346
			-0.0163***	-0.0118***	-0.0051	0.0094***
	Stdev	0.1567	0.0936	0.1150	0.1402	0.1830
	Min	0	0	0	0	0
	Max	1	1	1	1	1
B/M (mean)	N	13502	1978	1892	2021	7611
	Mean	0.6253	0.5592	0.5777	0.6398	0.6504
			-0.066***	-0.0475***	0.0144*	0.0251***
	Stdev	0.3184	0.2988	0.2958	0.3294	0.3221
	Min	0.0800	0.1000	0.1000	0.0800	0.0800
	Max	2.0100	2.0100	2.0100	1.8200	2.0100
Tobin's Q(stdev)	N	12470	1763	1677	1634	7396
	Mean	0.8186	1.0255	0.7807	0.8326	0.7748
			0.2069***	-0.0379*	0.0139	-0.0438***
	Stdev	0.8569	0.9575	0.8078	0.8718	0.8315
	Min	0.0076	0.0184	0.0081	0.0081	0.0076
	Max	4.7791	4.7386	4.7791	4.2949	4.7386

Table 5.1.1 (Continued): Descriptive Statistics of Regression Variables

Panel B: Regressor Statistics		All Stages	Peak	Recession	Trough	Boom
Capacity Util.	N	10578	1589	1660	1632	5697
	Mean	80.0515	81.6382	82.6672	79.2278	79.0828
			1.5866***	2.6156***	-0.8236***	-0.9687***
	Stdev	6.3253	4.6864	4.6781	6.8903	6.6613
	Min	52.2996	64.8866	65.6150	55.5330	52.2996
	Max	96.1467	93.6143	96.1467	95.0740	94.4648
Cash	N	12470	1763	1677	1634	7396
	Mean	2.7226	2.8530	2.7678	2.9230	2.6370
			0.1304***	0.0452*	0.2004***	-0.0856***
	Stdev	0.9336	0.9803	0.9176	0.7537	0.9506
	Min	0.0736	0.1819	0.2056	0.2409	0.0736
	Max	5.1181	4.6286	4.8065	4.8065	5.1181
Excess Cash	N	12350	1752	1657	1612	7329
	Mean	-0.0200	0.0167	-0.0075	0.0123	-0.0388
			0.0368***	0.0125***	0.0324***	-0.0187***
	Stdev	0.1859	0.1889	0.1775	0.2138	0.1777
	Min	-1.1978	-0.8667	-0.7618	-0.8658	-1.1978
	Max	1.5046	1.0688	1.3023	1.5046	1.5046
Assets	N	12470	1763	1677	1634	7396
	Mean	1.8956	1.8901	1.9035	1.9055	1.8929
			-0.0054	0.0079	0.0099*	-0.0026
	Stdev	0.2049	0.2011	0.2040	0.1980	0.2074
	Min	1.1410	1.2228	1.2228	1.4118	1.1410
	Max	2.5827	2.4723	2.3795	2.3836	2.5827
Industry Conc.	N	12470	1763	1677	1634	7396
	Mean	0.0471	0.0420	0.0474	0.0482	0.0480
			-0.0051***	0.0003	0.0010	0.0009
	Stdev	0.0752	0.0583	0.0696	0.0712	0.0807
	Min	0.0020	0.0022	0.0020	0.0020	0.0020
	Max	0.9613	0.3918	0.3918	0.4585	0.9613
D/E	N	12470	1763	1677	1634	7396
	Mean	0.9444	0.9211	1.0431	1.0622	0.9015
			-0.0232*	0.0987***	0.1178***	-0.0428***
	Stdev	0.4761	0.4690	0.5331	0.5485	0.4377
	Min	0.0855	0.1312	0.1312	0.0855	0.0855
	Max	5.5715	3.7881	4.8988	5.5715	5.5715
Asset Turnover	N	11954	1763	1677	1462	7052
	Mean	1.1178	1.1282	1.1080	1.0969	1.1219
			0.0103	-0.0097	-0.0208*	0.0040
	Stdev	0.4132	0.4120	0.4055	0.3937	0.4192
	Min	0.2783	0.2783	0.2783	0.3288	0.2862
	Max	2.7099	2.4852	2.3247	2.3833	2.7099

Table 5.1.1 (Continued): Descriptive Statistics of Regression Variables

Panel B: Regressor Statistics		All Stages	Peak	Recession	Trough	Boom
Capital Expenditure	N	11954	1763	1677	1462	7052
	Mean	0.0779	0.0847	0.0816	0.0791	0.0751
			0.0067***	0.0036***	0.0011	-0.0028***
	Stdev	0.0443	0.0575	0.0444	0.0406	0.0408
	Min	0.0068	0.0081	0.0081	0.0139	0.0068
	Max	0.4480	0.4480	0.3161	0.2462	0.3584
Employee Growth	N	11954	1763	1677	1462	7052
	Mean	0.0768	0.1102	0.1067	0.0868	0.0593
			0.0333***	0.0299***	0.0099***	-0.0175***
	Stdev	0.1113	0.1126	0.1044	0.1178	0.1075
	Min	-0.3903	-0.3903	-0.3903	-0.3692	-0.3692
	Max	0.8237	0.5967	0.8237	0.8237	0.8022
Profitability	N	12470	1763	1677	1634	7396
	Mean	-0.0845	-0.1167	-0.0794	-0.0997	-0.0747
			-0.0321***	0.0051	-0.0151	0.0098*
	Stdev	0.4043	0.4942	0.3713	0.4367	0.379
	Min	-5.2208	-5.2208	-5.2208	-4.2113	-4.4545
	Max	0.4163	0.2986	0.4163	0.4163	0.2986
R&D Expense	N	11726	1761	1646	1422	6897
	Mean	0.0233	0.0247	0.0219	0.0282	0.0222
			0.0014	-0.0014	0.0048***	-0.0010*
	Stdev	0.0420	0.0437	0.0367	0.0564	0.0390
	Min	0	0	0	0	0
	Max	0.4686	0.2710	0.2587	0.4686	0.4686
ROA	N	12470	1763	1677	1634	7396
	Mean	1.8334	1.6085	1.9954	1.9817	1.8176
			-0.2249*	0.1619	0.1482	-0.0158
	Stdev	5.0890	4.7299	5.2496	5.3138	5.0825
	Min	-38.1396	-17.9688	-29.0538	-29.0538	-38.1396
	Max	22.8938	18.7216	21.0978	22.8938	22.8938
Sales Growth	N	11954	1763	1677	1462	7052
	Mean	0.1620	0.2036	0.1992	0.1978	0.1353
			0.0416***	0.0371***	0.0358***	-0.0266***
	Stdev	0.1860	0.2011	0.1708	0.2231	0.1718
	Min	-0.3412	-0.1531	-0.1793	-0.1793	-0.3412
	Max	1.8955	1.3062	1.1612	1.2178	1.8955

Panel B presents the descriptive statistics of the main explanatory variables. A total of 3 macro-economic variables and 10 industry-specific control variables are used in this study. Asset turnover, capital expenditure, employee growth, profitability, R&D expense, ROA and sales growth are not used in the models directly, but rather to calculate the first principal component which is then used as a proxy for industry shocks (see section 4.1). The statistics are given for the entire sample period, as well as for the business cycle stage sub-periods. For each variable, the difference between the entire sample's mean and each sub-period's mean is given, along with the statistical significance (under the null hypothesis that the two means are equal). Statistical significance at the 1%, 5% and 10% level is denoted by ***, **, and *, respectively.

5.2 Preliminary Specification Tests

We start by doing three preliminary tests to determine the most appropriate estimation approach. Table 5.2.1 summarizes the results. Horizontal and non-horizontal mergers are tested separately, and we run the test on six different models as described in section 4.3.2. The first is the Breusch-Pagan (1980) test, which examines whether the random effects are significant enough to warrant the use of a panel specification rather than a pooled OLS regression. The test rejects the null hypothesis at the 1% significance level in all models, both for horizontal and non-horizontal mergers. This result indicates that industry effects vary significantly across industries and that a simple pooled OLS is not appropriate.[29] However, the rejection of the OLS model does not necessarily mean that the RE model is the most appropriate, since there is another alternative-the FE model.[30]

Next, the Hausman specification test is used to determine whether the RE or FE estimator is more appropriate for this data set. Rejection of the null implies that the FE estimator is more appropriate, otherwise RE is the best choice. In every model, both in the horizontal and non-horizontal set, the null hypothesis is not rejected even at the 10% level, providing evidence in favor of using an RE estimator.

The last test is the Davidson-Mackinnon test for endogeneity. A rejection of the null hypothesis suggests that the endogenous regressors have a significant effect on the estimates.[31] In every case, the null hypothesis is not rejected at the 5% level, suggesting that

[29] The Breusch-Pagan (1980) test specifically compares the RE (GLS) model with OLS.
[30] Alternatively, an F-test for fixed effects using the FE estimator yields similar results.
[31] It is important to note that an FE (within estimator) is used in deriving this test statistic. If either the RE or OLS models were used, it would be almost impossible to differentiate the endogeneity bias from other possible biases that can be present in these models (correlation of individual effects with the regressors for example). See Küng (2005) for further discussion.

endogeneity is not a problem in any of the models. Therefore it is not necessary to use 2SLS-RE or 2SLS-FE estimators.

Table 5.2.1: Preliminary Specification Tests

Panel A: Horizontal Mergers

		Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Breusch-Pagan LM test	chi_square	309.31	5509.07	3421.36	4422.11	670.03	783.51
for industry effects	p-value	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Hausman Specification	chi_square	4.76	0.00	0.04	0.16	5.93	8.03
test (RE vs FE)	p-value	0.942	0.999	0.948	0.984	0.313	0.155
Davidson-Mackinnon	F-stat	1.16	0.44	.	.	.	.
test for endogeneity	p-value	0.313	0.644	.	.	.	.

Panel B: Other mergers

		Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Breusch-Pagan LM test	chi_square	21.28	58.77	57.23	52.49	25.78	23.84
for industry effects	p-value	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Hausman Specification	chi_square	11.96	0.00	2.11	0.03	3.81	2.76
test (RE vs FE)	p-value	0.367	0.999	0.549	0.999	0.577	0.737
Davidson-Mackinnon	F-stat	0.29	0.16	.	.	.	.
test for endogeneity	p-value	0.752	0.856	.	.	.	.

Table 5.2.1 summarizes the preliminary specification tests. The endogeneity test can only be computed for Model 1 and 2, since only these models contain all three macroeconomic variables.

5.3 Aggregate Mergers and the business cycle

In the previous section we determined the most appropriate econometric model to use for our analysis. Next, we start our analysis in section 5.3.1 by introducing some basic merger activity trends and how they relate to the business cycle

5.3.1 Introduction

At each business cycle stage we calculate the monthly average number of mergers in all industries (shown in Figure 5.1). This figure clearly shows a pro-cyclical pattern in merger activity. Although the monthly average number of horizontal mergers is higher compared to non-horizontal mergers in all stages, both follow a similar pattern across the business cycle.

Figure 5.1: Horizontal and non-horizontal mergers at different business cycle stages

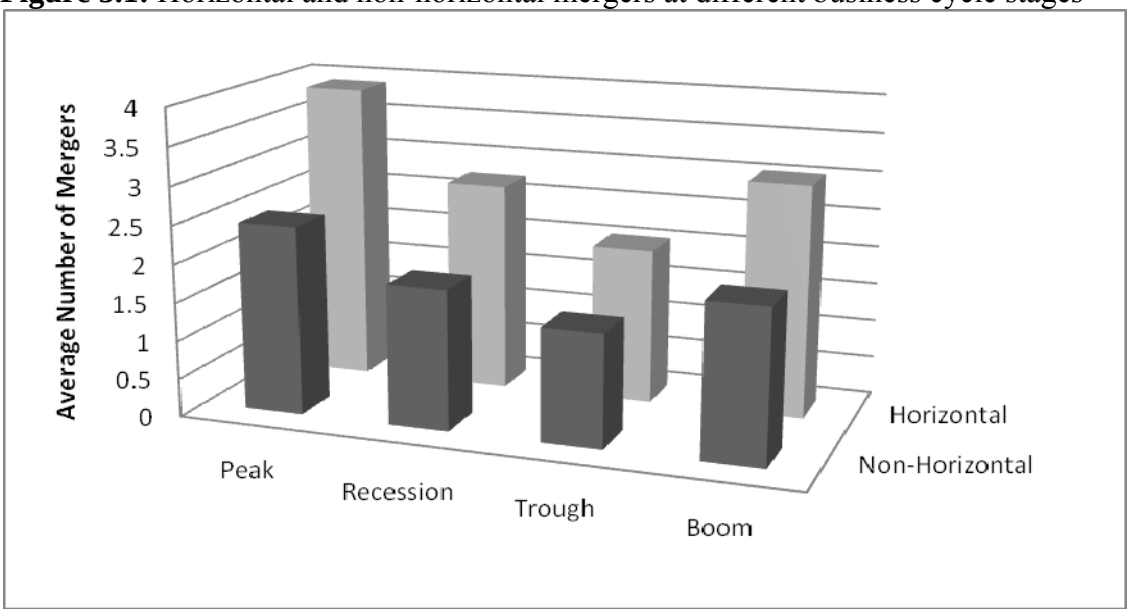

Figure 5.1 displays the merger concentrations across the business cycle. For each business cycle stage, this table gives average number of mergers per month in all industries. (i.e. Total number of mergers in a stage divided by total number of months within that stage)

Figure 5.2 suggests that other economy-wide effects influence industry level mergers. We control for the business cycle effects by comparing only one set of stages (in this case the boom stage). There are four boom stages in the sample period 1979 – 2006. In Figure 5.2

we see that the changes in industry distributions are relatively small going from one boom stage to the next. However changes in magnitude from one boom stage to the next are fairly large, for example between the second and third boom stage, merger activity seems to increase in virtually all industries. This suggests that industry level factors by themselves cannot explain all the variation in industry-level mergers, therefore macroeconomic factors should also be included.

Figure 5.2: Aggregate mergers across industries and four boom periods

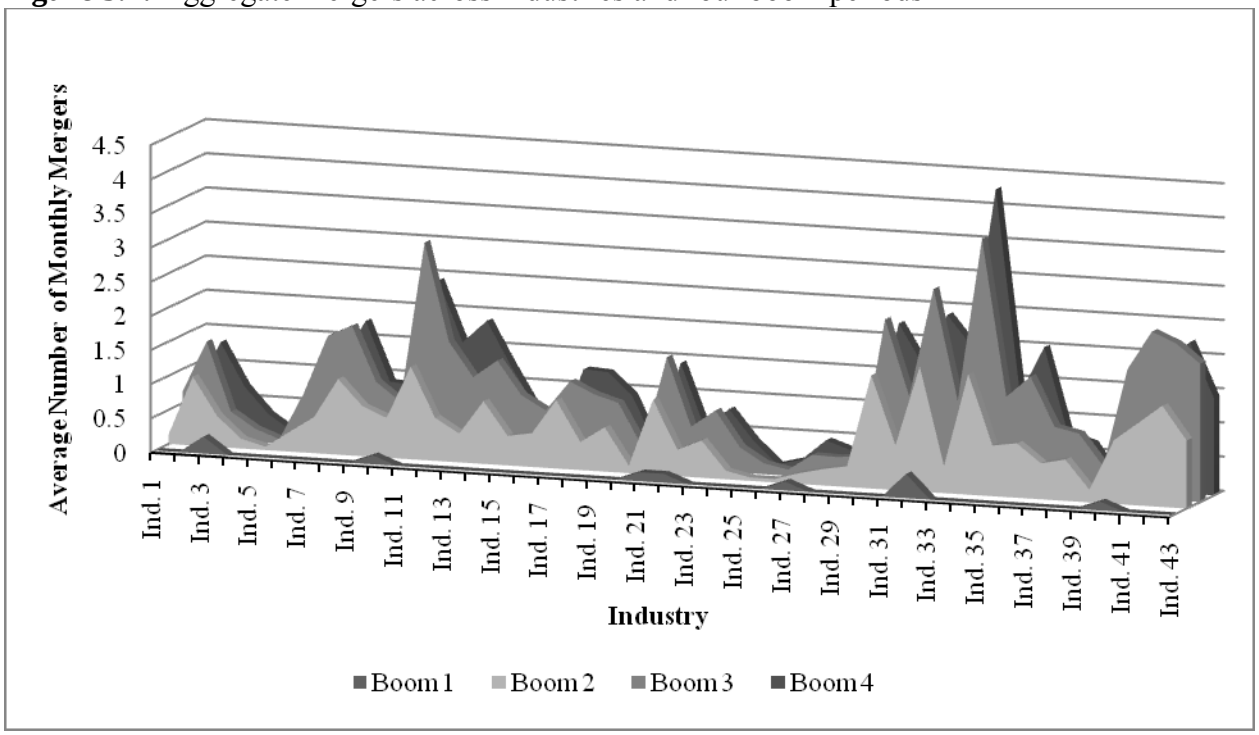

Figure 5.2 presents the distribution of average number of monthly mergers in each industry (total of 43) and each boom stage (total of 4). The first boom period is very short and lasts for one year (1980). The SDC database goes back to approximately 1979, which is why we have so few observations available for this period. More information on the industries is given in Table C and D in the Appendix.

Figure 5.3 shows that merger activity in all industries varies across the business cycle stages. The distribution of average mergers across industries seems to stay relatively constant, while average monthly mergers in all industries gradually increase from the trough period until the peak of the business cycle. These univariate results motivate us to examine

the relationship between underlying economic activity and industry level merger while controlling for known factors that affect them. This is consistent with Mitchell and Mulherin (1996, p.195) who conclude that "… a fruitful research design would consider the joint effect of macroeconomic and industry-level factors in modeling the behavior of takeovers over time".

Figure 5.3: Aggregate mergers across industries and business cycle stages

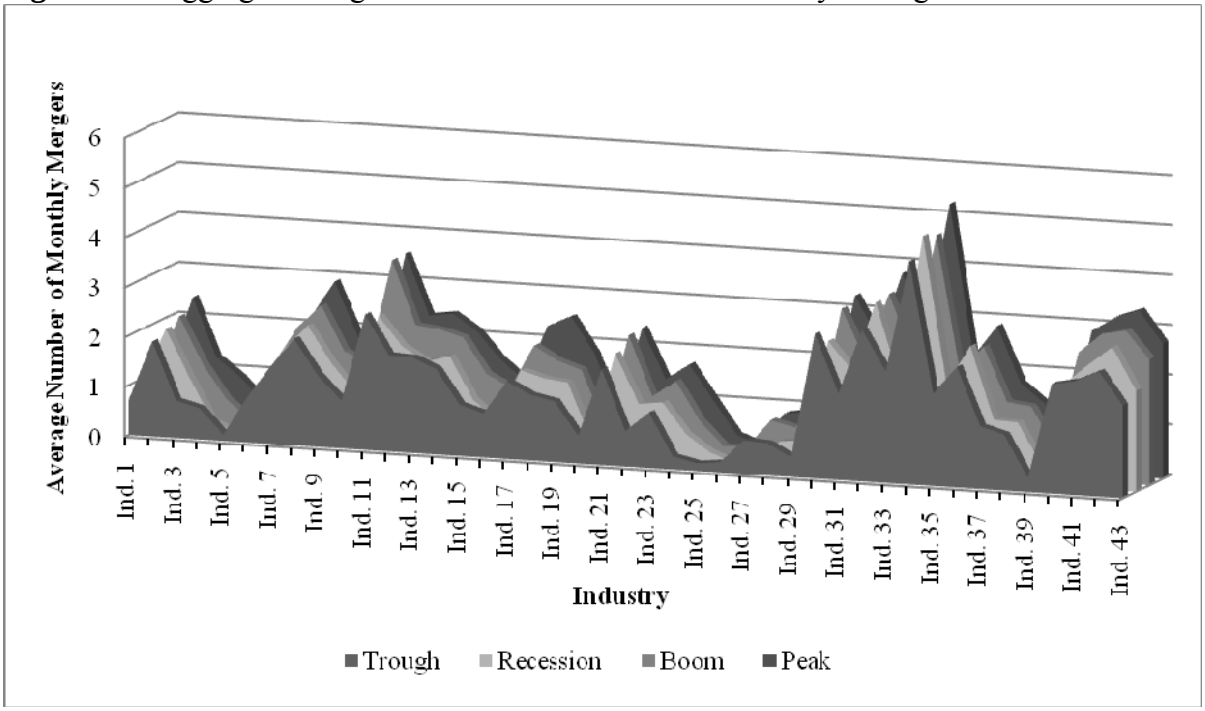

Figure 5.3 presents the distribution of average number of monthly mergers in each of the 43 industries and each business cycle stage. There are four complete cycles in our sample period and therefore each stage in the figure is a sum of 4 unique stages (i.e. the recession stage is the sum of 4 separate recessions in the sample period). Industry names and further information is given in Tables C and D of the Appendix.

Next, we present the results of the tests that examine the impact of the business cycle on merger activity after controlling for other economic and industry-specific variables.

5.3.2 Pro-cyclicality of mergers

[Table 5.3.1: Horizontal Mergers, Tobit Model]

[Table 5.3.2: Other Mergers, Tobit Model]

Table 5.3.1 presents the Tobit results based on equation 1 from section 4.3.1. In each model, the business cycle variable is positive and significant at 1%, which supports our hypothesis that horizontal mergers are pro-cyclical. The business cycle appears to have a similar effect on non-horizontal mergers as it does on horizontal mergers, which is in line with hypothesis 1.a. An increase of one unit in the business cycle variable (which corresponds to approximately 1.5 standard deviations) causes an increase of between 0.049% and 0.110% of an industry's assets to be involved in horizontal merger transactions. For non-horizontal mergers, a 1 unit increase in the business cycle variable corresponds to an increase between 0.124% and 0.232%.

[Table 5.3.3: Horizontal Mergers, Logit Model]

[Table 5.3.4: Other Mergers, Logit Model]

We obtain similar results from the Logit estimations. The business cycle coefficient is positive and significant at the 1% level. The results for both types of mergers are similar in magnitude as well as significance, in accordance with hypothesis 1.b. An increase in one unit of the business cycle variable increases the probability of a horizontal merger occurring by approximately 5-10%. For non-horizontal mergers, that number increases to 12-23%.

5.3.3 Determinants of industry-level merger activity

A. Tobit Models

Table 5.3.1 contains 6 models, each one of them (except for model 1) contains a set of variables which correspond to a specific merger theory. Model 1 contains all possible variables. We use this model to examine the relative strengths of each set of variables, when they are included in the same regression. Also, we use this model to test the robustness of

our results to missing variable bias, by examining whether a certain variable coefficient is still significant/insignificant after including variables from other non-related theories.

Models 1 and 2 of Table 5.3.1 provide evidence that macro-economic factors play an important role in the dynamics of aggregate mergers. The interest rates are negatively related to merger activity, as expected, and are significant at the 1% level in both models. The coefficient of market returns coefficient is positive and significant at 1% level, which is consistent with Weston (1961), Melicher, Ledolter and D'Antonio (1983) among others. This result can be interpreted in two ways. First, market returns can be an indicator of future economic conditions. In times of high market returns, firms may anticipate an increase in demand, and consequently expand their capacity through mergers and other investments. Second, high market returns can be an indicator of economy-wide overvaluation. In this case, agency costs associated with high market returns are likely to result in managers acquiring companies during those times (Ang and Cheng (2006), Dong et al. (2006) and Rhodes-Kropf and Viswanathan (2004)). In short, the results for models 1 and 2 indicate that at the aggregate level, both economic conditions (as measured by the business cycle) and capital market conditions have a significant impact on industry-level merger activity.

Model 3 in Table 5.3.1 isolates variables associated with the neoclassical theory of mergers, particularly the industry shock hypothesis. The industry shock coefficient is positive and significant at 1%, which is consistent with the majority of neoclassical studies including Harford (2005), Mitchell and Mulherin (1996), Mulherin and Boone (2000), Andrade et al. (2001) and Andrade and Stafford (2004). Surprisingly, industry deregulation does not seem to play a significant role in industry mergers. One reason for this might be that the industry deregulation effect is already accounted for in the industry shock variable.

Because a deregulation event has a significant impact on the accounting variables for all firms within an industry, and since a number of these variables are used in computing the industry shock variable, our industry shock variable might contain the deregulation effect. The results remain unchanged when we include all other variables (model 1).

Model 4 in Table 5.3.1 examines the overvaluation motives advanced by market-driven acquisition theories. The book to market ratio is negative and significant at 1%, suggesting that the general level of overvaluation has a significant impact on merger activity. These findings are consistent with Ang and Cheng (2006), Dong et al. (2006) and Rhodes-Kropf, Robinson, and Viswanathan (2005). Similarly, the dispersion of Tobin's Q within an industry is positive and significant at 1%. This is consistent with the Q theory of mergers (for example Jovanovic and Rousseau, (2002)), assuming that the Tobin's Q ratio is a measure of firm and management performance. However the coefficients of the overvaluation variables are insignificant in model 1, where all other variables are included. Both models 1, 3 and 4 support hypothesis 2.a, which states that horizontal mergers are more influenced by neo-classical rather than overvaluation motives.

Models 5 and 6 examine other industry-specific variables that do not fall under the previous theories. The only difference between the two is that model 5 includes Cash reserves, while model 6 uses excess cash reserves. The two variables are highly correlated and cannot be included in the same model. As expected, industry concentration is negative and significant, suggesting that industrial organization motives play an important role in industry-level mergers. Lower industry concentration implies a larger number of potential acquirers and targets; a situation where defensive mergers are more likely to occur (Gorton, Kahl and Rosen (2005)). Average Cash reserve has a positive and significant impact at the

1% level, which is in accordance with Jensen (1986) and Harford (1999), who find that firms with relatively high cash reserves are more likely to be involved in mergers due to various agency costs. In the absence of agency problems, the results might indicate a certain degree of market imperfection, implying that firms need to rely largely on internally generated funds to finance the transactions (Andrade and Stafford (2004)).

The coefficient on the D/E ratio is negative, although insignificant. A negative D/E ratio coefficient is consistent with Gugler and Konrad (2002) who find that firms involved in mergers have different financial structures than non-merging firms. In particular, the D/E ratios of acquiring firms are significantly lower (relative to both non-merging and target firms), which supports the theory that acquirers use mergers to adjust their debt-equity ratios. It also supports the argument that acquirers with high leverage face higher financing constraints (Harford, Klasa and Walcott, 2007).

Finally, the coefficient of capacity utilization is positive and significant, implying that mergers are generally driven by expansionary motives. This conclusion supports the findings of Becketti (1986)[32], but is in direct contrast to the results of Andrade and Stafford (2004) and Jensen (1993), who find a negative coefficient for capacity utilization, arguing that mergers are motivated by reducing excess capacity while industry expansion at peak capacity levels is facilitated through direct investment.

The magnitude and significance of coefficients does not change when macroeconomic, neo-classical and behavioral variables are included in the model. The overall results suggest that at the aggregate level, both the economic and transaction environment play an important role for horizontal mergers. The business cycle has

[32] However Becketti (1986) uses economy-wide capacity utilization, while Andrade and Stafford (2004) and this study use the industry-level counterpart.

incremental explanatory power over both sets of variables. This can be attributed to the fact that our proxy of business cycle captures market and business conditions much more accurately and is more comprehensive than traditional macroeconomic variables, e.g. market returns, interest rates and capacity utilization. The business cycle variable is statistically significant even after controlling for more specific industry-level variables.

Diversifying Mergers

Table 5.3.2 examines the determinants of non-horizontal mergers. The parameter estimates for the macro-economic variables are very similar, in magnitude and significance, to those of the horizontal merger set. Both the transaction environment and financing constraints have a similar impact on horizontal and non-horizontal mergers.

The same is true for neo-classical variables: industry shocks have a positive and significant effect on non-horizontal mergers. This is somewhat surprising, and contrary to the second part of hypothesis 2, which states that non-horizontal mergers are less influenced by neo-classical variables. We would expect industry shocks to induce asset restructuring within the industry only. However the industry shock coefficient is insignificant in model 1 where all variables are included. When both model 1 and 3 are taken into account, it appears that the neo-classical variables have less explanatory power for non-horizontal mergers, which is in accordance with hypothesis 2.b. Similar to the horizontal set, the deregulation variable is insignificant, which again could be caused by the industry shock variable implicitly capturing the effect of deregulation.

For the overvaluation variables, only the average B/M ratio is significant. This is expected, since the variation of Tobin's Q variable only captures opportunities for horizontal mergers. However the B/M ratio is insignificant in model 1.

In models 5 and 6, industry concentration and cash reserves are similar to the horizontal set. However capacity utilization and D/E ratio differ significantly. Capacity utilization is insignificant, suggesting that economic conditions (and expansionary motives in particular) are not a driving force behind non-horizontal mergers. Unlike the horizontal set, the D/E ratio is negative and significant for non-horizontal mergers. This further supports our hypothesis that non-horizontal mergers are driven more by the transaction environment and financing constraints than by economic conditions.

In Appendix C we examine whether models 3-6 in Tables 5.3.1 and 5.3.2 are susceptible to missing variable bias. The results seem robust to different model specifications.

Tables 5.3.1 and 5.3.2 raise a few interesting points about aggregate merger determinants. First, macro-economic variables, and especially the business cycle, have a very similar effect on both types of mergers. However, there is much more variation in the industry-level determinants between the two types of mergers. For the horizontal set, industry shocks and capacity utilization play a significant role. These mergers are closely aligned with the neo-classical theory. Non-horizontal mergers on the other hand seem to be motivated by different factors. Capacity utilization and industry shocks are insignificant, but financing constraints (either cash or debt) seem to play a larger role.

In Tables 5.3.1 and 5.3.2 it is difficult to compare the goodness of fit of each model. Because our Random Effects model uses maximum likelihood estimation, we can estimate a

pseudo R^2 statistic.[33] However this is a very rough measure of explanatory power, and its value can be >1 or <0 (in most of our models it is negative). We use three alternative measure of goodness of fit. These include the Akaike's information criterion (AIC) and Bayesian Information Criterion (BIC), which are useful to compare relative explanatory power between models.[34] We also include a rough measure of absolute explanatory power, defined as the correlation of predicted merger values with the observed merger values.[35]

The predictive power of the models is relatively low: the correlation between predicted and actual values is close to 0.05 for horizontal mergers and 0.03 for non-horizontal mergers. In both tables the models with industry-level variables have more explanatory power than macroeconomic models. This is expected since industry-level models can more accurately capture various industry conditions.

B. Logit Models

In this section we use Logit analysis to determine which variables explain whether an industry undertakes mergers within a particular month. Table 5.3.3 presents the results of the Logit regressions on industry-level horizontal merger activity. The coefficients of macro-economic variables, as well as those of industry-specific variables are virtually the same in both sign and significance as the ones in the Tobit regressions (Table 5.3.1). Similarly for non-horizontal mergers the results are very close to those obtained in Table 5.3.2. These results provide further support for hypothesis 2.a and 2.b in chapter 3, namely that horizontal

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[33] Pseudo R^2 is calculated as $R^2 = 1 - \frac{\ln(L(M_{full})}{\ln(L(M_{constant})}$. Where L is the estimated likelihood, M_{full} is the full model with all regressors, and $M_{constant}$ is a model with only an intercept and no regressors.

[34] The AIC and BIC are defined as: AIC=2(k)-2ln(L) , BIC=-2(ln(L))+k(ln(n)). Where k is the number of parameters, L is the estimated likelihood, and n is the sample size.

[35] This measure is used in papers like Harford (2005)

and non-horizontal mergers are primarily affected by neo-classical and behavioral variables, respectively. Because of the similarity between the Tobit and Logit models, we can infer that the merger determinants including the business cycle, affect not only the magnitude of merger activity within industries, but the likelihood of mergers occurring as well.

Table 5.3.1: Horizontal Mergers, Tobit Model

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Macroeconomic Variables						
Business Cycle (x100)	0.107***	0.086***	0.084***	0.110***	0.068***	0.049**
	[3.63]	[5.35]	[4.17]	[6.00]	[2.88]	[2.55]
Interest Rates (x10)	-0.373***	-0.551***				
	[-3.70]	[-16.20]				
Market Return (x10)	0.377***	0.025***				
	[4.46]	[4.44]				
Neoclassical Variables						
Industry Shock (x1000)	0.588***		0.830***			
	[4.83]		[10.5]			
Deregulation (x1000)	0.247		0.307			
	[0.20]		[0.49]			
Behavioral Variables						
B/M mean (x100)	0.019			-0.446***		
	[0.25]			[-9.31]		
Tobin's Q stdev (x1000)	-0.045			0.564***		
	[-0.22]			[3.93]		
Other Variables						
Industry Concentration (x10)	-0.190***				-0.255***	-0.239***
	[-2.98]				[-4.28]	[-4.07]
Capacity Utilization ($x10^4$)	0.729***				0.919***	0.978***
	[2.63]				[4.15]	[4.53]
D/E mean (x1000)	0.711*				-0.049	-0.027
	[1.67]				[-0.12]	[-0.07]
Excess Cash (x100)						0.440***
						[7.13]
Cash mean (x100)	0.082***				0.151***	
	[3.57]				[10.83]	
Assets(x1000)	0.868				-0.553	-0.182
	[0.55]				[-0.41]	[-0.13]
Constant (x10)	-0.131***	-0.029***	-0.059***	-0.055***	-0.147***	-0.115***
	[-3.18]	[-7.97]	[-19.90]	[-11.40]	[-4.28]	[-3.41]
Correlation of predicted values with observed mergers	0.0563	0.0526	0.091	0.0577	0.0156	0.0206
AIC	-18715.65	-29000.23	-28469.48	-29162.23	-17346.57	-17336.09
BIC	-18610.01	-28955.19	-28425.39	-29117.78	-17282.98	-17272.50

Statistical significance at the 1%, 5% and 10% levels is denoted by ***, **, and *, respectively. The T-statistic under the null hypothesis that parameter estimates equals zero, is given in the brackets.

Table 5.3.2: Other Mergers, Tobit Model

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Macroeconomic Variables						
Business Cycle (x100)	0.232***	0.131***	0.132***	0.125***	0.151***	0.124***
	[5.30]	[5.43]	[4.44]	[5.04]	[4.29]	[3.47]
Interest Rates (x10)	-0.344**	-0.678***				
	[-2.39]	[-13.30]				
Market Return (x10)	0.024*	0.317***				
	[1.91]	[3.76]				
Neoclassical Variables						
Industry Shock (x1000)	0.193		0.849***			
	[1.07]		[6.67]			
Deregulation (x1000)	0.028		-0.118			
	[0.01]		[-0.12]			
Behavioral Variables						
B/M mean (x100)	-0.168			-0.521***		
	[-1.47]			[-7.42]		
Tobin's Q stdev (x1000)	-0.461			0.322		
	[-1.51]			[1.58]		
Other Variables						
Industry Concentration (x10)	-0.336***				-0.347***	-0.367***
	[-4.69]				[-5.15]	[-5.27]
Capacity Utilization ($x10^4$)	-0.825**				0.191	0.318
	[-2.01]				[0.56]	[0.91]
D/E mean (x1000)	-1.180*				-0.018***	-0.017***
	[-1.80]				[-3.07]	[-2.87]
Excess Cash (x100)						0.368***
						[3.68]
Cash mean (x100)	0.135***				0.165***	
	[4.10]				[7.85]	
Assets(x1000)	-0.328				-0.022	-0.020
	[-1.55]				[-1.12]	[-0.97]
Constant (x10)	0.063	-0.269***	-0.722***	-0.428***	-0.748	-0.429
	[1.10]	[-3.02]	[-9.04]	[-4.53]	[-1.49]	[-0.84]
Correlation of predicted values with observed mergers	0.0156	0.0319	0.0279	0.0308	0.0092	0.0058
AIC	-16156.03	-26688.54	-24668.66	-25919.46	-16758.7	-16396.51
BIC	-16050.40	-26643.50	-24624.58	-25875.02	-16694.82	-16332.74

Statistical significance at the 1%, 5% and 10% levels is denoted by ***, **, and *, respectively. The T-statistic under the null hypothesis that parameter estimates equals zero, is given in the brackets.

Table 5.3.3: Horizontal Mergers, Logit Model

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Macroeconomic Variables						
Business Cycle	0.253***	0.270***	0.080*	0.202***	0.163***	0.223***
	[3.94]	[6.83]	[1.71]	[5.09]	[3.16]	[4.28]
Interest Rates	-10.420***	-23.290***				
	[-4.83]	[-26.82]				
Market Return	0.730***	0.542***				
	[3.98]	[3.91]				
Neoclassical Variables						
Industry Shock	0.183***		0.291***			
	[5.63]		[10.97]			
Deregulation	0.242		-0.054			
	[0.70]		[-0.30]			
Behavioral Variables						
B/M mean	0.070			-1.423***		
	[0.42]			[-12.28]		
Tobin's Q stdev	-0.046			0.202***		
	[-1.01]			[6.19]		
Other Variables						
Industry Concentration	-8.416***				-10.680***	-11.430***
	[-4.47]				[-5.61]	[-6.15]
Capacity Utilization (x10)	0.203***				0.194***	0.134**
	[3.30]				[3.49]	[2.40]
D/E mean (x10)	0.041				0.526	0.39
	[0.04]				[0.59]	[0.43]
Excess Cash					1.828***	
					[9.22]	
Cash mean	0.289***					0.475***
	[5.88]					[14.67]
Assets	-0.658*				-0.783**	-1.139***
	[-1.86]				[-2.43]	[-3.65]
Constant	-0.709	1.283***	-0.209	0.422	-0.157	-0.333
	[-0.76]	[5.13]	[-0.90]	[1.59]	[-0.19]	[-0.41]
Correlation of predicted values with observed mergers	0.3898	0.2183	0.2418	0.1331	0.3273	0.3475
AIC	8399.184	13352.35	11823.56	12449.22	8860.243	8813.555
BIC	8497.775	13389.88	11860.3	12486.26	8916.925	8884.408

Statistical significance at the 1%, 5% and 10% levels is denoted by ***, **, and *, respectively. The T-statistic under the null hypothesis that parameter estimates equals zero, is given in the brackets.

Table 5.3.4: Other Mergers, Logit Model

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Macroeconomic Variables						
Business Cycle	0.374***	0.214***	0.168***	0.195***	0.156***	0.225***
	[6.06]	[5.83]	[3.82]	[5.20]	[3.15]	[4.50]
Interest Rates	-5.262**	-16.96***				
	[-2.54]	[-21.48]				
Market Return	0.553***	0.652***				
	[3.12]	[5.02]				
Neoclassical Variables						
Industry Shock	0.095***		0.280***			
	[3.07]		[11.56]			
Deregulation (x10)	0.450		0.144			
	[0.17]		[0.98]			
Behavioral Variables						
B/M mean	-0.181			-1.295***		
	[-1.11]			[-11.99]		
Tobin's Q stdev	-0.006			0.140***		
	[-0.14]			[4.37]		
Other Variables						
Industry Concentration	-7.748***				-8.624***	-8.850***
	[-5.26]				[-6.17]	[-6.49]
Capacity Utilization (x10)	-0.021				0.571	0.024
	[-0.34]				[1.05]	[0.04]
D/E mean (x10)	-1.080				-0.138	-0.179**
	[-1.11]				[-1.54]	[-1.96]
Excess Cash					1.672***	
					[8.57]	
Cash mean	0.362***					0.442***
	[7.65]					[14.18]
Assets	-0.626**				-0.38	-0.603**
	[-1.97]				[-1.29]	[-2.10]
Constant	0.663	0.753***	-0.345*	0.297	0.278	-0.081
	[0.77]	[3.71]	[-1.86]	[1.42]	[0.37]	[-0.11]
Correlation of predicted values with observed mergers	0.3918	0.1846	0.2224	0.1533	0.3209	0.3465
AIC	8882.05	14809.43	12945.32	13647.51	9342.458	9301.835
BIC	8980.64	14846.96	12982.06	13684.55	9399.14	9372.687

Statistical significance at the 1%, 5% and 10% levels is denoted by ***, **, and *, respectively. The T-statistic under the null hypothesis that parameter estimates equals zero, is given in the brackets.

5.3.4 Merger activity determinants in different business cycle stages

In the previous section we examined evidence for hypothesis 1 and 2. In this section, we examine hypothesis 3. That is, whether the effects of merger determinants change over the business cycle stages, and which factors are the most important in each stage.

[Table 5.3.5: Determinants in different BC stages]

The first column in Table 5.3.5 examines the determinants of horizontal mergers. The coefficients of B/M mean, the dispersion of Tobin's Q and the D/E mean, have similar significance levels in all stages. Namely, they are not significant at 5% level in any of the stages. Note however that B/M mean and the dispersion of Tobin's Q are significant when the sample is not divided into individual business cycle stages (see Table 5.3.1). The second column in Table 5.3.5 looks at non-horizontal mergers. Here market returns, industry shocks, B/M mean, Capacity utilization, and excess cash are not significantly different from zero in any of the business cycle stages. Each one of these variables, with the exception of capacity utilization is jointly significant (see Table 5.3.2) when all stages are bundled together. This suggests that these variables are significant determinants of aggregate mergers, however we find no evidence that they are significantly more important in one stage compared to others.

In the Boom stage, interest rates, capacity utilization and excess cash are all significant at the 5% level for horizontal mergers. This suggests that at this business cycle stage, horizontal mergers are much more widely used for economic purposes. They are much more likely to be used to expand output capacity, and are more likely to be financed with cash and debt. Note again that this does not mean that these are the only motivations for

mergers during this stage. As seen in Table 5.3.1, overvaluation variables (B/M mean and dispersion of Tobin's Q) are still significant across the entire sample period.

During the same period, non-horizontal mergers (second column of Table 5.3.5) seem to be more motivated by financing constraints (relative to horizontal mergers). Industry shocks, capacity utilization, and excess cash are insignificant determinants at the 5% level. However interest rates, industry concentration and D/E ratio are significant. During economic expansion, non-horizontal mergers are undertaken primarily by acquirers with readily available funds, especially debt.

In the Peak stage, market returns are significant determinants for horizontal mergers. At the same time excess cash becomes insignificant and interest rates become less significant, which suggests that a larger number of the mergers are financed by stock. It is interesting to note that the B/M ratio is not significant in this stage, which is contrary to what we would expect. Capacity utilization is positive and significant, which means that expansionary motives play a large role at the peak of the business cycle. For non-horizontal mergers, market timing still plays a larger than average role in this stage compared to other stages. The dispersion of Tobin's Q is negative and significant, suggesting that acquirers in very concentrated industries are more likely to look for targets in other industries.

We would expect that the overvaluation motive is not prevalent in the recession and trough stages, times during which the industries and the markets as a whole are least overvalued. The results in Table 5.3.5 seem to support this view. For non-horizontal mergers, only the dispersion of Tobin's Q and industry concentration are significant. For horizontal mergers on the other hand, overvaluation motives decrease even more, while economic motives increase. The magnitude of the coefficients for both interest rates and

market return start to decrease, economic factors such as industry shocks and capacity utilization increase and the magnitude of the cash variable decreases (in fact becomes negative). This suggests that during this stage, the role of acquirer's financing constraints and the transaction environment decreases, while the role of the economic conditions becomes increasingly more important.

Our last prediction is regarding capacity utilization. We have shown that capacity utilization only affects horizontal mergers, which is what we expect since only horizontal mergers can increase or decrease excess capacity. However, we expect to see an expansionary motive during the boom and peak stages and contractionary motive during the recession and trough. We do not find supporting evidence for this hypothesis. For horizontal mergers, the capacity utilization coefficient is positive and significant in all stages except for the trough (where it is positive and insignificant). This suggests that horizontal mergers play an expansionary role in all stages of the business cycle, and firms use other means to reduce firm size.

The results in this section provide some evidence for hypothesis 2 which argues that variables associated with the neo-classical theory have more explanatory power for horizontal mergers while overvaluation variables are more valid for diversifying mergers. Furthermore, we find support for hypothesis 3, in that the purpose of mergers varies across business cycle stages for both types of mergers.

These results have some interesting implications regarding the post-merger performance of cash and stock acquirers. The overvaluation theory of mergers argues that since stock acquirers are overvalued at the time of a merger and their main motivation is to purchase assets with their stock, they do not necessarily make economically sound

acquisitions. Therefore their long-run post-merger performance will be less than that of cash acquirers(empirical evidence is provided by Loughran and Vijh (1997) and Rau and Vermaelen (1998) among others). Based on the results in this section, we can also argue that the timing of stock-financed mergers (with respect to the business cycle) could also explain some of the below average post-event performance. As can be seen in Table 5.3.5, overvaluation seems to have the strongest effect on mergers near the peak of the business cycle. The largest number of market-driven acquisitions seems to take place in this stage. Therefore the long-term performance of a stock-financed merger will be measured during the recession and low stages of the business cycle. On the other hand, cash-financed mergers seem to be mostly concentrated during the boom stages of the business cycle. Therefore the relatively high post-merger performance of these companies could be due in large part to the generally strong economic growth.

Table 5.3.5: Determinants in different BC stages

	Horizontal	Other
Interest Rates		
Boom (x10)	-0.514***	-0.484***
	[-5.58]	[-3.49]
Peak	-0.085**	-0.168***
	[-2.55]	[-3.31]
Recession (x10)	-0.701***	-0.685
	[-2.64]	[-1.64]
Trough (x10)	-0.418	-0.830
	[-0.89]	[-1.17]
Market Return		
Boom (x100)	0.194*	0.053
	[1.81]	[0.32]
Peak (x100)	0.982***	0.649*
	[4.21]	[1.79]
Recession (x100)	0.734**	0.890*
	[2.31]	[1.79]
Trough (x100)	0.255	-0.307
	[0.64]	[-0.51]
Industry Shock		
Boom (x1000)	0.325*	-0.164
	[1.65]	[-0.52]
Peak (x1000)	0.616**	0.010
	[2.35]	[0.02]
Recession (x100)	0.102***	-0.034
	[3.20]	[-0.70]
Trough (x1000)	0.308	-0.164
	[0.84]	[-0.30]
B/M mean		
Boom (x100)	0.045	-0.158
	[0.54]	[-1.26]
Peak (x100)	0.280*	-0.359
	[1.68]	[-1.35]
Recession (x100)	-0.187	-0.273
	[-0.99]	[-0.94]
Trough (x100)	-0.346*	0.213
	[-1.95]	[0.78]
Tobin's Q st.dev		
Boom (x1000)	-0.512*	-0.786*
	[-1.95]	[-1.93]
Peak (x100)	0.035	-0.187***
	[0.83]	[-2.70]
Recession (x100)	0.038	0.238***
	[0.64]	[2.80]
Trough (x1000)	0.028	0.856
	[0.04]	[0.85]

(continued)	Horizontal	Other
Industry Concentration		
Boom (x10)	-0.155**	-0.289***
	[-2.31]	[-3.80]
Peak (x10)	-0.074	-0.472***
	[-0.77]	[-3.02]
Recession (x10)	-0.495***	-0.472***
	[-3.85]	[-3.26]
Trough (x10)	-0.095	-0.301**
	[-1.03]	[-2.37]
Capacity Utilization		
Boom (x1000)	0.101***	0.024
	[3.45]	[0.53]
Peak (x1000)	0.252***	-0.082
	[3.19]	[-0.67]
Recession (x1000)	0.309***	-0.061
	[3.72]	[-0.48]
Trough (x104)	0.118	0.843
	[0.18]	[0.86]
D/E mean		
Boom (x100)	-0.020	-0.198**
	[-0.34]	[-2.22]
Peak (x100)	0.135	0.001
	[1.30]	[0.01]
Recession (x1000)	0.121	-0.355
	[0.14]	[-0.26]
Trough (x100)	0.085	-0.150
	[0.99]	[-1.05]
Excess Cash		
Boom (x100)	0.227**	0.141
	[2.00]	[0.80]
Peak (x100)	-0.256	0.030
	[-1.17]	[0.08]
Recession (x100)	-0.549**	-0.027
	[-2.15]	[-0.07]
Trough (x100)	0.173	0.309
	[0.62]	[0.73]
Intercept		
Boom	-0.006	0.007
	[-0.98]	[0.82]
Peak	-0.021**	0.024*
	[-2.56]	[1.91]
Recession	-0.022***	0.010
	[-2.65]	[0.81]
Constant	-0.003	-0.010
	[-0.54]	[-1.14]

5.3.5 Target and Acquirer characteristics (by stage)

In the previous sections we have shown that 1) horizontal and non-horizontal mergers are driven by different forces and 2) the motivations and financing preferences for both types of mergers change across the different stages of the business cycle. This section looks at the firm-level characteristics and attempts to further support these results by examining the changes between the acquirers across merger types and business cycle stages. Table 5.3.6 analyzes the characteristics of acquirer firms between horizontal and non-horizontal mergers. We separate acquirers into two groups, depending on the type of merger, and compare the average performance, financial constraints, overvaluation and size between the two groups. We take natural logs of P/E ratio, assets, cash, leverage, Tobin's Q and sales since the original data are not normally distributed in either group. The top and bottom 1% of observations for B/M ratio, beta, employee growth, asset returns, profitability and return on assets have been winsorized at each tail to ensure that the mean is minimally affected by outliers. The difference between the means of diversifying merger acquirers and horizontal merger acquirers is calculated and reported in Table 5.3.6. The p-values correspond to the test that the difference between the mean of the two populations is zero.[36] Differences highlighted in bold face are significant at 5%.

Firm Performance: We use 3 different variables to measure firm performance: employee growth, profitability and return on assets. Overall, we expect acquirers from horizontal mergers to be more profitable. As we have seen in section 5.3.1, horizontal mergers are used as a tool to expand current capacity, unlike non-horizontal mergers. Firms that are performing above average will be operating at or close to full capacity and will

[36] The T-test used to derive these p-values assumes unequal variances between the two groups.

acquire less successful firms within its own industry to increase capacity. Non-horizontal acquirers are more likely to be overvalued, in which case the high stock prices do not reflect good performance. Overall, we find that non-horizontal acquirers have on average lower performance than horizontal acquirers, however there doesn't appear to be any clear pattern across the business cycle.

Financing constraints: Although financial constraints are important for both types of mergers, and for all types of investments in general, non-horizontal mergers are particularly dependent on it. Many market-timing mergers will be financed with stock, but a vast majority are financed with a combination of stocks, cash and debt. Since we have already argued that market-timing mergers do not perform as well as their horizontal acquirer counterparts, they are likely to have lower cash flows and (excess) cash reserves. Therefore most over-valuation motivated acquirers will also have to have relatively low cost of debt (low D/E ratio) in order to successfully complete an acquisition.[37] This is exactly what we see in Table 5.3.6. The cash levels and the D/E ratio are both significantly lower for non-horizontal mergers in almost all stages of the business cycle.

Over-valuation: Because we hypothesize that diversifying mergers are more motivated by overvaluation, acquirers involved in these mergers are expected to be more overvalued. That means that they have lower B/M ratios, higher Tobin's Q ratio, and higher P/E ratios. On the other hand, horizontal acquirers have better performance, and this fact is also reflected in these ratios. This might explain the significant B/M ratio in Table 5.3.1, the ratio might simply represent industry performance, which would have a positive effect on merger activity. The variables seem to be reflecting performance more than overvaluation,

[37] In fact we observe this in Table 5.3.2, where the leverage is significant at 1%, while for horizontal mergers in Table 5.3.1 it is insignificant.

since the average horizontal acquirer has lower B/M ratio, higher Tobin's Q and higher P/E ratio in all stages of the business cycle.

Firm Size: Finally, we compare the average firm size using total assets and total sales. There is very little difference in asset size between horizontal and non-horizontal acquirers. However, in terms of sales volume, horizontal acquirers are significantly larger.

In summary, we find significant differences between horizontal and non-horizontal acquirers, giving further support to hypothesis 2. The fact that the acquirers have significantly different characteristics in certain stages but not in others suggests that the purpose of mergers depends on both the type of merger and the stage of the business cycle that it occurs in. However, it is not clear how the differences in characteristics change over the business cycle stages.

Table 5.3.6: Differences between Acquirers across stages

	All Stages	Peak	Recession	Trough	Boom
Performance					
Employee	-0.048***	-0.060***	-0.218**	-0.001	-0.014
	[0.001]	[0.001]	[0.025]	[0.936]	[0.202]
Profitability	-0.036	0.050	-0.050	-0.215***	-0.030
	[0.100]	[0.188]	[0.624]	[0.004]	[0.205]
ROA	-0.574**	0.524	0.278	-2.747**	-0.753**
	[0.039]	[0.264]	[0.804]	[0.038]	[0.013]
Financial Constraint					
Cash	-0.254***	-0.134**	-0.261***	-0.14	-0.321***
	[0.000]	[0.017]	[0.001]	[0.132]	[0.000]
Leverage	-0.07***	0.096**	-0.066	-0.123**	-0.131***
	[0.000]	[0.021]	[0.270]	[0.046]	[0.000]
Over-valuation					
B/M Ratio	0.04***	0.063***	0.056***	0.017	0.018***
	[0.000]	[0.000]	[0.001]	[0.428]	[0.000]
Tobin's Q	-0.02***	-0.077***	-0.025	-0.046**	0.007
	[0.002]	[0.000]	[0.267]	[0.030]	[0.345]
P/E Ratio	-0.053***	-0.076***	-0.087**	-0.056	-0.023
	[0.000]	[0.001]	[0.031]	[0.234]	[0.122]
Size					
Assets	-0.036*	0.007	-0.066	-0.037	-0.047*
	[0.089]	[0.861]	[0.310]	[0.639]	[0.082]
Sales	-0.133***	-0.078**	-0.191***	-0.127*	-0.164***
	[0.000]	[0.033]	[0.002]	[0.096]	[0.000]
Other					
Beta	-0.053**	-0.113**	-0.032	-0.044	-0.049*
	[0.015]	[0.046]	[0.757]	[0.293]	[0.081]
N (Horizontal)	17410	3496	2236	1739	9939
N (Non-Horizontal)	13416	2964	1797	1347	7308

This table presents the difference between non-horizontal and horizontal acquirer characteristics at the time of the merger announcement. The p-values for each coefficient are reported in parentheses. P/E ratio, assets, cash, leverage, Tobin's Q and sales are log scaled since their distribution was not normally distributed in either group. For the remaining variables, including B/M ratio and firm beta, the top and bottom 1% of observations have been winsorized at each tail to ensure that the mean is minimally affected by outliers. Statistical significance at the 1%, 5% and 10% levels is denoted by ***, **, and *, respectively. The T-statistic under the null hypothesis that parameter estimates equals zero, is given in the brackets.

5.3.6 Robustness test

In section 5.3.1 we have demonstrated that the business cycle has significant explanatory power in predicting industry-level merger activity. However many studies have shown that the regulatory and transaction environment in the 1980's and 1990's varied significantly and as a result the acquisition landscape was very different between the two decades (See for example Dong et al. (2005)). To test whether our results hold after controlling for this, we split the sample period into two sub-periods. The first period covers years 1979-1990, and the second 1991-2006.

Panel A of Table 5.3.7 presents the results for horizontal mergers. In both periods, the business cycle is positive, but is much more significant in the second half of the sample period. With the exception of industry concentration, it is the second most consistent variable in both sign and significance. In the first half of the sample period, the interest rates are negative and significant, while the market returns are insignificant. In the second part, market returns are positive while interest rates are insignificant. This result is consistent with the findings of Andrade, Mitchell and Stafford (2001), who find that in the 1980's the vast majority of mergers were financed with debt (over 80%), while in the 1990's that figure drops to below 30%. Similarly, Schleifer and Vishny (2003) find that the stock market valuation was significantly less in the 1980's than in the 1990's. Industry shocks and B/M ratios are insignificant in the first half of the sample period, but are significant at 1% in the second half. Finally, the capacity utilization variable is also insignificant in the first part and significant in the next period. This is to some extent consistent with Andrade and Stafford (2004) and Jensen (1993). They argue that in the 1970's and 1980's, the majority of mergers

were used to eliminate excess capacity, while in the 1990's they were used for capacity expansion.

Panel B of Table 5.3.7 presents the results of the non-horizontal set. The business cycle variable is even more consistent for non-horizontal mergers. Market returns are positive and significant in both periods, while the interest rates are only significant in the first half of the sample period. However the sign of the coefficient is negative, which is somewhat difficult to interpret. The industry shock variable and both overvaluation variables are insignificant in the first half, and significant at 1% in the second half. Table 5.3.7 shows that industry-level merger activity is highly pro-cyclical, regardless of the type of merger or period examined.

Table 5.3.7: Tobit regression in different decades

Panel A: Horizontal Mergers

Horizontal mergers	1979-1990				1991-2006			
	Model 1	Model 2	Model 3	Model 4	Model 1	Model 2	Model 3	Model 4
Business Cycle (x100)	0.132***	0.070	0.079***	0.061	0.175***	0.240***	0.223***	0.150***
	[5.38]	[1.61]	[2.99]	[1.54]	[4.97]	[8.45]	[7.49]	[3.63]
Interest Rates (x10)	-0.320***				0.008			
	[-3.63]				[0.06]			
Market Return (x100)	-0.076				0.337***			
	[-0.77]				[3.25]			
Industry Shock (x1000)		-0.153				0.637***		
		[-0.43]				[5.42]		
Deregulation (x100)		0.125				-0.012		
		[0.76]				[-0.11]		
B/M mean (x100)			0.010				-0.229**	
			[0.09]				[-2.47]	
Tobin's Q stdev (x1000)			0.098				-0.144	
			[0.10]				[-0.79]	
Industry Conc. (x10)				-0.256***				-0.192***
				[-3.42]				[-2.69]
Capacity Util. ($x10^4$)				0.058				0.880**
				[0.10]				[2.28]
D/E mean (x100)				0.114*				0.086
				[1.70]				[1.51]
LnAssets mean (x100)				0.008				0.168
				[0.04]				[0.79]
Excess Cash (x100)				-0.125				0.218**
				[-0.38]				[2.48]
Constant (x10)	-0.047***	-0.073***	-0.073***	-0.108*	-0.048***	-0.040***	-0.028***	-0.157***
	[-4.67]	[-8.69]	[-5.59]	[-1.72]	[-4.05]	[-4.60]	[-2.62]	[-2.86]
N	5676	3744	4284	3162	8084	7728	7896	5782
Correlation of predicted and observed values	0.0484	-0.0265	0.0305	0.0036	0.0442	0.0786	0.0479	0.0189
AIC	-5594.652	-6265.963	-7120.200	-4549.516	-22736.88	-22805.32	-22759.22	-14189.29
BIC	-5554.788	-6228.595	-7082.024	-4494.985	-22694.90	-22763.6	-22717.38	-14129.33

Statistical significance at the 1%, 5% and 10% levels is denoted by ***, **, and *, respectively. The T-statistic under the null hypothesis that parameter estimates equals zero, is given in the brackets.

Panel B: Other Mergers

Other mergers	1979-1990				1991-2006			
	Model 1	Model 2	Model 3	Model 4	Model 1	Model 2	Model 3	Model 4
Business Cycle (x100)	0.178***	0.131***	0.054**	0.056	0.232***	0.294***	0.268***	0.263***
	[7.52]	[3.07]	[2.16]	[1.60]	[5.09]	[7.49]	[6.91]	[4.45]
Interest Rates (x10)	0.507***				-0.138			
	[5.77]				[-0.85]			
Market Return (x100)	0.349***				0.290**			
	[3.57]				[2.16]			
Industry Shock (x1000)		-0.576*				0.678***		
		[-1.67]				[4.11]		
Deregulation (x100)		0.185				-0.007		
		[1.09]				[-0.04]		
B/M mean (x100)			0.139				-0.344***	
			[1.42]				[-2.85]	
Tobin's Q stdev (x1000)			-0.710				-0.494**	
			[-0.81]				[-2.04]	
Industry Conc. (x10)				-0.368***				-0.308***
				[-4.52]				[-3.45]
Capacity Util. ($x10^4$)				-0.560				-0.458
				[-1.09]				[-0.85]
D/E mean (x100)				-0.031				-0.153*
				[-0.41]				[-1.78]
LnAssets mean (x100)				0.120				-0.354
				[0.53]				[-1.17]
Excess Cash (x10)				-0.101***				0.011
				[-3.06]				[0.88]
Constant (x10)	-0.127***	-0.075***	-0.073***	-0.044	-0.058***	-0.064***	-0.040***	0.049
	[-11.5]	[-11.5]	[-6.63]	[-0.70]	[-4.41]	[-6.96]	[-3.45]	[0.63]
N	5544	3744	4284	3162	7896	7728	7896	5764
Correlation of predicted and observed values	0.0062	-0.0048	-0.0048	0.0025	0.0358	0.0302	0.0344	0.0126
AIC	-7428.79	-5584.00	-6590.68	-4427.07	-19724.3	-19456.54	-19730.62	-12454.64
BIC	-7389.07	-5546.63	-6552.50	-4372.54	-19682.45	-19414.82	-19688.78	-12394.70

Statistical significance at the 1%, 5% and 10% levels is denoted by ***, **, and *, respectively. The T-statistic under the null hypothesis that parameter estimates equals zero, is given in the brackets.

CHAPTER 6
CONCLUSION

6.1 Concluding Remarks

Early studies have examined the effect of macroeconomic variables on aggregate mergers, and found a pro-cyclical pattern (Becketti 1986). In the last 15 years, merger activity research has started to shift from analyzing aggregate mergers to industry-level and firm level mergers (most likely because of more data availability). This line of research has moved into two directions.

One set of studies finds that industry-level variables, such as industry shocks, play a primary role in explaining aggregate merger activity. Mitchell and Mulherin (1996) find that the 5 most merger-intensive industries have a disproportionally higher level of merger activity, accounting for more than 50% of all mergers during a merger wave and only 14% of the assets. The second set finds that overvaluation can explain not only merger waves (in times of high investor optimism and stock overvaluation) but also type of financing used (stock). Overvaluation and investor optimism are particularly tied to the business cycle.

It remains unclear whether the macroeconomic variables have any explanatory power after controlling for these more specific motivations. We address this question by examining the effect of one particularly important macroeconomic variable, the business cycle, on industry-level merger activity. Furthermore, we examine whether mergers are used for different purposes across the business cycle stages. For example we hypothesize that horizontal mergers are primarily used to increase output in the expansion stage, to profit from market miss-pricing in the peak stage, and eliminate excess capacity in the recession stage. Finally, we examine whether the motives behind horizontal and non-horizontal mergers are different. The results indicate that

the business cycle plays a significant role in not only predicting merger activity, but also in determining the motivation behind many mergers.

Specific results obtained from this study find that the business cycle has a positive and significant effect on both horizontal and non-horizontal mergers, even after controlling for other known macro-economic determinants. It has not only a significant effect on the probability of a merger occurring within an industry, but also on the level of merger activity. Furthermore, the business cycle can explain whether or not an industry will start a merger wave in any particular month.

We also find that the industry-level motivations and financing preferences change across different business cycle stages, suggesting that mergers are used for different roles at different stages of the economy. Finally, significant differences exist between the type of mergers (horizontal vs. non-horizontal) and their determinants, financing preferences, and timing with respect to the business cycle.

The most critical implication of this study is that the manager's information about the current economic state is crucial in his decisions regarding mergers and acquisitions. Regardless of whether a firm merges due to industry shocks, overvaluation, or industrial organization motives, the current state of the economy will play a significant role in the timing of mergers. Managers who are considering the acquisition of another firm will examine macroeconomic factors to determine the long term benefits of the potential merger (for example whether demand will continue growing); they will examine industry level and firm specific factors to determine the firm's relative performance compared to its peers, and which potential targets will make most efficient use of the available assets.

6.2 Limitations

This study contains several limitations which future research could potentially address. First, we exclude all mergers with private acquirers, because financial data for these firms is not readily available. If such data becomes available, it would be interesting to test whether private acquisitions are driven by the same factors as their public counterparts, as well as differences in financing and post-merger performance.

Second, our study is very dependent on industry classification as all analysis is done at the industry level. We allocate all firms in Compustat (as well as all targets and acquirers in the SDC database) into the Fama and French (1997) classifications using the primary SIC codes. Because databases have differing criteria for determining the primary SIC code, it becomes somewhat vague and for any given firm it can vary across different databases. For example, Kahle and Walking (1996) find that 36% of companies listed on both CRSP and Compustat do not match at the 2 digit level. This could be a potential problem, since our dependent variable (industry-level merger activity) and industry-level control variables could vary depending on different criteria of assigning primary SIC codes.

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Appendix A

Table A1: Other Mergers, Tobit Model

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Macroeconomic Variables						
Boom (x100)	0.094	0.084*	0.173***	0.190***	0.138**	0.112*
	[1.43]	[1.95]	[3.69]	[4.37]	[2.45]	[1.95]
Peak (x100)	0.136*	0.077	0.247***	0.237***	0.224***	0.213***
	[1.71]	[1.44]	[4.44]	[4.46]	[3.23]	[3.02]
Recession (x1000)	-0.288	-0.029	0.331	0.484	0.513	0.279
	[-0.36]	[-0.05]	[0.57]	[0.88]	[0.71]	[0.38]
Interest Rates (x10)	-0.291*	-0.711***				
	[-1.92]	[-13.60]				
Market Return (x100)	0.247*	0.341***				
	[1.87]	[3.70]				
Neoclassical Variables						
Industry Shock (x1000)	0.184		0.818***			
	[1.01]		[6.36]			
Deregualtion (x1000)	0.818		0.136			
	[0.40]		[0.10]			
Behavioral Variables						
B/M mean (x100)	-0.146			-0.543***		
	[-1.27]			[-7.52]		
Tobin's Q stdev (x1000)	-0.330			0.287		
	[-1.08]			[1.40]		
Other Variables						
Industry Concentration (x10)	-0.335***				-0.339***	-0.360***
	[-4.65]				[-5.02]	[-5.15]
Capacity Utilization ($x10^4$)	-0.005				0.136	0.257
	[-0.01]				[0.38]	[0.71]
D/E mean (x100)	-0.169**				-0.146**	-0.140**
	[-2.57]				[-2.41]	[-2.28]
Excess Cash (x100)						0.372***
						[3.68]
Cash mean (x100)	0.110***				0.168***	
	[3.32]				[7.91]	
Assets (x100)	-0.215				-0.195	-0.176
	[-1.00]				[-1.00]	[-0.86]
Constant (x100)	-0.255	-0.317***	-0.866***	-0.571***	-0.913*	-0.557
	[-0.44]	[-3.23]	[-9.66]	[-5.64]	[-1.77]	[-1.06]
Correlation of predicted values with observed mergers	0.0074	0.0234	0.0192	0.0221	0.0029	0.0003
AIC	-16131.37	-25438.04	-24674.93	-24722.69	-15573.67	-15543.22
BIC	-16011.65	-25378.19	-24616.15	-24663.63	-15495.95	-15465.49

Statistical significance at the 1%, 5% and 10% levels is denoted by ***, **, and *, respectively. The T-statistic under the null hypothesis that parameter estimates equals zero, is given in the brackets.

Table A2: Horizontal Mergers, Tobit Model

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Macroeconomic Variables						
Boom (x100)	0.103**	0.067**	0.144***	0.154***	0.124***	0.120***
	[2.30]	[2.50]	[4.55]	[5.28]	[3.93]	[3.78]
Peak (x100)	0.134**	0.100***	0.234***	0.229***	0.190***	0.173***
	[2.49]	[3.02]	[6.22]	[6.41]	[4.90]	[4.47]
Recession (x100)	0.0375	0.031	0.109***	0.090**	0.079**	0.069*
	[0.70]	[0.93]	[2.79]	[2.45]	[1.98]	[1.71]
Interest Rates (x10)	-0.307***	-0.464***				
	[-2.91]	[-14.3]				
Market Return (x100)	0.341***	0.222***				
	[3.80]	[3.91]				
Neoclassical Variables						
Industry Shock (x1000)	0.581***		0.794***			
	[4.75]		[9.92]			
Deregualtion (x1000)	0.508		0.56			
	[0.41]		[0.68]			
Behavioral Variables						
B/M mean (x100)	0.0104			-0.353***		
	[0.13]			[-7.74]		
Tobin's Q stdev (x1000)	0.0162			0.384***		
	[0.08]			[2.87]		
Other Variables						
Industry Concentration (x10)	-0.190***				-0.224***	-0.222***
	[-2.96]				[-6.78]	[-6.33]
Capacity Utilization ($x10^4$)	1.060***				0.618***	0.708***
	[3.91]				[3.38]	[3.81]
D/E mean (x1000)	0.632				0.246	0.264
	[1.49]				[0.83]	[0.87]
Excess Cash (x100)						0.539***
						[7.40]
Cash mean (x100)	0.078***				0.110***	
	[3.38]				[9.29]	
Assets (x100)	0.135				-0.078	-0.102
	[0.86]				[-0.99]	[-1.22]
Constant (x10)	-0.178***	-0.025***	-0.072***	-0.048***	-0.115***	-0.086***
	[-4.28]	[-5.80]	[-17.80]	[-9.57]	[-5.16]	[-3.81]
Correlation of predicted values with observed mergers	0.0574	0.0505	0.092	0.06	0.0199	0.0255
AIC	-18707.58	-28266.62	-28496.95	-28548.23	-17356.48	-17348.6
BIC	-18587.87	-28206.76	-28438.17	-28489.16	-17278.75	-17270.88

Statistical significance at the 1%, 5% and 10% levels is denoted by ***, **, and *, respectively. The T-statistic under the null hypothesis that parameter estimates equals zero, is given in the brackets.

Table A3: Industry Classification and Distribution of Horizontal Mergers

Industry number	Industry Name	Number of firms	Industry Size	Average Monthly Horizontal Activity				
				Total	Boom	Peak	Recession	Trough
1	Agriculture	18	0.12	3.88	3.51	5.66	4.28	3.02
2	Food Products	86	3.14	164.37	117.42	162.98	413.57	76.41
3	Candy and Soda	8	0.26	57.29	48.25	82.28	64.96	56.66
4	Beer and Liquor	15	0.77	13.63	17.02	9.97	1.71	17.46
5	Tobacco Products	5	1.18	27.66	30.70	71.44	0.00	2.25
6	Recreation	44	0.73	20.49	27.40	17.97	14.77	4.52
7	Entertainment	72	0.74	105.62	99.18	267.20	56.09	20.30
8	Printing and Publishing	54	0.71	122.87	121.19	154.96	151.72	67.90
9	Consumer Goods	114	1.59	89.87	58.82	118.14	98.77	162.07
10	Apparel	73	0.45	33.66	43.13	42.26	10.28	15.85
11	Healthcare	89	0.51	351.44	461.87	353.91	217.67	97.78
12	Medical Equipment	160	0.48	235.00	125.83	874.53	85.88	143.19
13	Pharmaceutical Products	200	2.82	699.69	475.03	411.70	2157.79	283.87
14	Chemicals	86	3.02	225.92	224.08	330.39	294.64	59.90
15	Rubber and Plastic Products	57	0.22	19.60	27.65	18.22	10.57	1.91
16	Textiles	44	0.26	19.66	22.05	34.76	5.27	11.10
17	Construction Materials	108	1.45	64.25	80.75	94.64	24.13	17.48
18	Construction	64	0.73	41.90	24.16	34.80	58.19	94.50
19	Steel Works Etc	77	1.66	78.77	60.66	91.87	192.68	13.38
20	Fabricated Products	28	0.07	0.93	1.22	0.36	0.00	1.39
21	Machinery	177	2.48	111.31	114.16	86.56	192.30	43.01
22	Electrical Equipment	73	2.44	9.00	9.92	8.70	12.88	2.15
23	Automobiles and Trucks	67	14.46	61.59	41.30	214.25	40.19	4.94
24	Aircraft	26	1.20	83.61	118.34	116.14	1.92	13.14
25	Shipbuilding and Railroad Eq.	8	0.32	4.56	0.99	16.81	1.54	8.18
26	Defense	9	0.24	6.41	5.45	0.76	0.00	21.89
27	Precious Metals	26	0.28	13.09	18.02	1.86	16.95	2.87
28	Non-Metallic Mining	18	0.59	11.82	7.04	10.40	40.62	0.65
29	Coal	6	0.07	29.39	27.10	81.34	11.14	5.12
30	Petroleum and Natural Gas	210	9.99	1342.94	656.77	3215.03	2005.15	1240.69
31	Utilities	188	10.12	713.39	525.91	1050.69	1350.17	391.42
32	Communication	112	12.83	2808.49	1646.49	8629.87	3076.44	906.43
33	Personal Services	54	0.44	37.85	29.95	125.40	5.45	12.78
34	Business Services	432	3.35	1029.09	661.78	1711.48	2155.97	500.33
35	Computers	232	3.47	265.79	99.71	282.00	438.52	656.67
36	Electronic Equipment	277	2.47	569.42	308.75	423.06	1866.63	305.21
37	Measuring and Control Eq.	119	0.34	29.51	41.53	17.05	14.76	14.59
38	Business Supplies	57	1.88	120.61	125.64	235.10	33.38	79.65
39	Shipping Containers	16	0.29	8.06	6.47	13.64	11.42	4.77
40	Transportation	106	4.37	154.29	199.65	83.95	74.44	145.44
41	Wholesale	206	2.10	92.46	82.16	160.81	27.45	127.91
42	Retail	252	4.57	400.73	391.99	937.77	207.50	101.94
43	Restaurants, Hotels, Motels	93	0.76	180.72	228.73	177.15	155.70	41.22

Table A3 reports the industry classifications and their respective merger activities across business cycle stages. Number of firms represents the average number of public firms within an industry during the sample period. Industry size is reported as the percentage of an industry's assets to the total assets in all 43 industries. Average monthly activity is calculated as the sum of all transaction values during a period divided by the number of months in that period (values are reported in millions of dollars).

Table A4: Industry Classification and Distribution of Other Mergers

Industry number	Industry Name	Number of firms	Industry Size	Average Monthly Non-Horizontal Activity				
				Total	Boom	Peak	Recession	Trough
1	Agriculture	18	0.12	6.20	8.03	9.50	0.88	1.98
2	Food Products	86	3.14	43.17	26.19	66.51	27.37	96.00
3	Candy and Soda	8	0.26	69.53	16.98	85.78	1.69	307.21
4	Beer and Liquor	15	0.77	6.73	0.33	4.23	25.40	12.61
5	Tobacco Products	5	1.18	95.77	4.55	6.00	583.46	6.67
6	Recreation	44	0.73	50.93	13.23	94.47	183.23	5.63
7	Entertainment	72	0.74	208.35	276.49	152.77	205.28	26.83
8	Printing and Publishing	54	0.71	75.11	98.30	85.87	46.44	12.43
9	Consumer Goods	114	1.59	259.77	396.82	250.84	30.77	21.00
10	Apparel	73	0.45	16.71	16.16	42.28	8.09	2.38
11	Healthcare	89	0.51	41.34	53.90	43.79	18.28	18.40
12	Medical Equipment	160	0.48	98.74	67.18	138.73	29.56	240.88
13	Pharmaceutical Products	200	2.82	162.49	163.83	310.91	66.43	110.27
14	Chemicals	86	3.02	166.44	81.57	48.27	710.69	25.26
15	Rubber and Plastic Products	57	0.22	31.93	22.82	95.42	29.39	4.27
16	Textiles	44	0.26	19.00	11.11	11.63	4.00	69.20
17	Construction Materials	108	1.45	69.69	57.79	120.13	43.12	89.10
18	Construction	64	0.73	62.58	31.12	86.27	197.28	12.41
19	Steel Works Etc	77	1.66	63.43	81.64	28.04	79.75	17.55
20	Fabricated Products	28	0.07	12.51	14.00	17.97	8.88	5.62
21	Machinery	177	2.48	138.47	113.52	401.87	60.29	47.54
22	Electrical Equipment	73	2.44	92.59	155.48	29.80	18.59	8.87
23	Automobiles and Trucks	67	14.46	111.18	82.28	280.76	97.65	60.15
24	Aircraft	26	1.20	121.03	65.88	407.12	106.53	48.89
25	Shipbuilding and Railroad Eq.	8	0.32	1.91	2.81	2.59	0.00	0.00
26	Defense	9	0.24	40.77	50.66	79.25	4.78	5.03
27	Precious Metals	26	0.28	3.59	5.35	0.60	3.31	0.62
28	Non-Metallic Mining	18	0.59	14.22	21.37	4.77	9.06	3.69
29	Coal	6	0.07	6.08	7.13	3.00	0.00	11.64
30	Petroleum and Natural Gas	210	9.99	155.93	109.92	389.00	121.78	123.75
31	Utilities	188	10.12	234.78	225.27	405.17	140.64	197.09
32	Communication	112	12.83	482.13	313.97	1180.92	604.70	262.30
33	Personal Services	54	0.44	33.54	39.98	37.76	19.88	20.72
34	Business Services	432	3.35	885.13	265.08	521.09	4080.18	160.60
35	Computers	232	3.47	331.37	163.80	446.06	956.92	169.28
36	Electronic Equipment	277	2.47	202.47	135.97	248.07	415.96	173.48
37	Measuring and Control Eq.	119	0.34	58.78	55.07	85.95	70.58	33.15
38	Business Supplies	57	1.88	61.95	72.62	62.58	63.15	22.66
39	Shipping Containers	16	0.29	14.80	19.62	19.14	0.56	8.17
40	Transportation	106	4.37	63.41	85.27	39.17	46.15	28.05
41	Wholesale	206	2.10	185.61	137.48	539.25	100.61	94.49
42	Retail	252	4.57	92.51	77.70	225.94	55.06	51.88
43	Restaurants, Hotels, Motels	93	0.76	53.97	59.68	101.31	14.40	27.83

Table A4 reports the industry classifications and their respective merger activities across business cycle stages. Number of firms represents the average number of public firms within an industry during the sample period. Industry size is reported as the percentage of an industry's assets to the total assets in all 43 industries. Average monthly activity is calculated as the sum of all transaction values during a period divided by the number of months in that period (values are reported in millions of dollars).

Appendix B

Table B1: Correlation Coefficients of Regression Variables

	Business Cycle	*Interest Rate*	*Market Return*	*Industry Shock*	*Dereg-ulation*	*B/M*	*Tobin's Q (log, Std)*	*Capacity Util.*	*Cash (log)*	*Excess Cash (log)*	*Assets (log)*	*Industry Conc.*	*D/E*
Business Cycle	1												
Interest Rate	**-0.2113**	1											
Market Return	0.1516	0.0783	1										
Industry Shock	-0.1067	-0.2227	-0.086	1									
Deregulation	-0.0002	0.0572	0.0017	0.0135	1								
B/M	0.1329	0.4021	0.0329	-0.3607	0.1043	1							
Tobin's Q (log,Std)	-0.0684	-0.4495	-0.1889	0.402	-0.083	**-0.3427**	1						
Capacity Util.	0.0584	0.125	0.1652	-0.0078	-0.0921	-0.062	-0.0941	1					
Cash (log)	-0.212	-0.6164	-0.0994	0.2899	0.0121	-0.3538	0.3974	-0.0328	1				
Excess Cash (log)	-0.1245	-0.3908	-0.1344	0.3891	-0.0062	-0.1766	0.3011	-0.1168	0.4109	1			
Assets (log)	0.0033	0.1115	0.0236	-0.4898	-0.0009	0.3401	-0.3421	0.0089	-0.1671	0.0008	1		
Ind. Conc.	-0.0012	0.0325	-0.0325	-0.2132	-0.0582	0.0759	0.0971	-0.0682	-0.1199	-0.0733	0.1877	1	
D/E	-0.1619	-0.0309	-0.0936	-0.2069	0.0328	0.1238	-0.2636	0.0092	-0.1429	0.0161	**0.2669**	0.1051	1

Table B1 reports the correlation matrix of the explanatory variables. Correlation coefficients higher than 0.2 are presented in bold face.

Table B2: Collinearity Diagnostics

Variable	VIF	Sqrt(VIF)	Tolerance	R-Squared		Eigenval.	Cond. Index
Business cycle	1.42	1.19	0.705	0.295	1	2.1462	1
Market Return	1.37	1.17	0.7295	0.2705	2	1.5745	1.1675
Interest Rates	2.11	1.45	0.4746	0.5254	3	1.4615	1.2118
Cap. Util.	1.09	1.04	0.9167	0.0833	4	1.0662	1.4188
Assets (log)	1.57	1.25	0.6372	0.3628	5	0.8209	1.6169
B/M	1.74	1.32	0.5742	0.4258	6	0.7277	1.7173
Tobin's Q (log, stdev)	1.67	1.29	0.5994	0.4006	7	0.4869	2.0994
D/E	1.12	1.06	0.8955	0.1045	8	0.4506	2.1824
Cash (log)	1.27	1.13	0.7857	0.2143	9	0.2654	2.8434
Mean VIF	1.48				Condition Number		2.8434

Table B2 presents two collinearity diagnostics. The first column gives the variance inflation factors (VIFs). A VIF of more than 10 is an indicator of a potential multi-collinearity problem (alternatively if Tolerance equals 0.1 or R-squared equals 0.9). None of the above variables have VIFs higher than 2.5, with the average VIF being less than 1.5. This indicates very little collinearity among the regressors. Similarly, eigenvalues close to zero or condition numbers higher than 15 indicate potential collinearity problems.

Table B1 presents the correlation matrix of the regressors. Within each group, correlations higher than 0.2 are presented in bold face, these include the correlation between Interest rates and the business cycle, B/M ratio and dispersion of Tobin's Q, and D/E ratio and asset size. These could present potential multi-collinearity problems. A number of other variables have high correlations, but because they are not used in the same model, they are not of primary concern. To examine this further, we run several collinearity diagnostics, with the results presented in Table B2. The first column gives the variance inflation factors (VIFs). A VIF of more than 10 is an indicator of a potential multi-collinearity problem (alternatively if Tolerance equals 0.1 or R-squared equals 0.9). None of the above variables have VIFs higher than 2.5, with the average VIF being less than 1.5. This indicates very little collinearity among the explanatory variables. Similarly, eigenvalues close to zero or condition numbers higher than 15 indicate potential collinearity problems. This does not seem to be the case. The results in Table B2 suggest that multi-collinearity is not a great concern in our models.

Appendix C

Tables 5.3.1 and 5.3.2 break down industry-specific variables into 3 groups: neoclassical, behavioral, and other variables. But how would our results look if we include all industry-specific variables in one model? Table C1 summarizes these results. Because some industry-specific variables are highly correlated, we create 4 different models, leaving out different set of variables in each model.

Table C1: All Industry-specific Variables, Tobit Model

Panel A: Horizontal Mergers	Model 1	Model 2	Model 3	Model 4
Industry Shock (x1000)	0.387**		0.509***	
	[2.24]		[4.45]	
Deregualtion (x1000)	-0.047	-0.403	-0.074	-0.352
	[-0.05]	[-0.46]	[-0.08]	[-0.39]
B/M mean (x100)	-0.260***	-0.342***		
	[-3.98]	[-5.98]		
Tobin's Q stdev (x1000)			0.030	0.241
			[0.16]	[1.37]
Industry Concentration (x10)	-0.218***	-0.189***	-0.211***	-0.248***
	[-3.42]	[-3.20]	[-3.42]	[-4.12]
Capacity Utilization (x1000)	0.093***	0.080***	0.108***	0.096***
	[3.72]	[3.65]	[4.5]	[4.25]
D/E mean (x1000)	0.150	0.250	-0.173	0.042
	[0.37]	[-0.64]	[-0.42]	[0.11]
Excess Cash (x100)	0.197**	0.337***		
	[2.22]	[5.27]		
Cash mean (x100)			0.124***	0.142***
			[7.67]	[9.31]
Assets (x1000)	0.867	0.329	0.433	-0.410
	[0.57]	[0.24]	[0.29]	[-0.3]
Constant (x10)	-0.121***	-0.090***	-0.172***	-0.154***
	[-3.19]	[-2.66]	[-4.62]	[-4.35]
Panel B: Non-Horizontal Mergers	Model 1	Model 2	Model 3	Model 4
Industry Shock (x1000)	-0.157		0.216	
	[-0.58]		[1.23]	
Deregualtion (x1000)	0.129	0.307	-0.051	0.104
	[0.08]	[0.19]	[-0.03]	[0.07]
B/M mean (x100)	-0.450***	-0.429***		
	[-4.51]	[-4.8]		
Tobin's Q stdev (x1000)			-0.168	-0.014
			[-0.59]	[-0.05]

Industry Concentration (x10)	-0.353***	-0.324***	-0.376***	-0.348***
	[-4.78]	[-4.61]	[-5.32]	[-5.14]
Capacity Utilization (x10^4)	-0.110	0.009	0.006	0.019
	[-0.29]	[0.26]	[0.16]	[0.54]
D/E mean (x100)	-0.201***	-0.200***	-0.190***	-0.184***
	[-3.15]	[-3.27]	[-3.01]	[-3.05]
Excess Cash (x100)	0.282**	0.240**		
	[2.00]	[2.32]		
Cash mean (x100)			0.164***	0.167***
			[6.69]	[7.21]
Assets (x100)	-0.231	-0.103	-0.318	-0.219
	[-1.06]	[-0.51]	[-1.51]	[-1.1]
Constant (x100)	0.245	-0.174	-0.433	-0.746
	[0.45]	[-0.34]	[-0.79]	[-1.43]

Statistical significance at the 1%, 5% and 10% levels is denoted by ***, **, and *, respectively. The T-statistic under the null hypothesis that parameter estimates equals zero, is given in the brackets.

Panel A of Table C1 gives the results for the horizontal set. With only one exception, all variables have identical signs and significance levels as in Table 5.3.1, which suggests that our results are robust even when the variables are broken down into sub-groups. The industry-specific models in Table 5.3.1 are not susceptible to omitted variable bias. The only exception is the dispersion of Tobin's Q. When all variables are included, it becomes insignificant.

Similar to the horizontal set, all variables contain identical signs and significance levels with only one exception. In the non-horizontal case, the industry shock variable is insignificant. This is in line with our hypothesis that non-horizontal mergers are not driven by economic factors, including industry shocks.

Appendix D

A second set of Logit regressions are performed using industry merger waves as the dependent variable. More specifically, we estimate Logit models to determine which macro-economic and industry-specific variables impact merger wave starts. We calculate the merger waves using the Harford (2005) procedure. Between 1981 and 2001, 35 industry waves from 28 industries are identified, with each wave lasting 24 months (As suggested by Mitchell and Mulherin (1996)). For industry *i*, the industry wave variable will equal 1 in periods when industry *i* is undergoing a merger wave and 0 otherwise. Table D1 indicates that the business cycle variable has some ability to predict industry-level merger waves. However this effect is significantly lower compared to the models in previous sections which examined general merger activity. Among the other macro-economic variables, only the market return is significant (1% level). It is surprising that interest rates, which are significant in the previous Tobit and Logit specifications, are not a significant factor in predicting merger waves. At the industry level, both industry shocks and B/M ratios have significant explanatory power, which supports both the neo-classical and behavioral theories of mergers.

These results suggest that industry shocks, overvaluation and macro-economic factors are the main determinants of industry merger waves, with the macroeconomic model having the most explanatory power.

Table D1: Merger Wave Starts, Logit Model

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Macroeconomic Variables						
Business Cycle	1.625*	1.329**	0.771*	0.915**	0.918*	1.155*
	[1.82]	[2.48]	[1.94]	[2.28]	[1.72]	[1.89]
Interest Rates	-13.710	-13.13				
	[-0.63]	[-1.57]				
Market Return	4.811**	6.443***				
	[2.57]	[4.71]				
Neoclassical Variables						
Industry Shock	0.276*		0.179**			
	[1.67]		[2.33]			
Deregualtion	-26.400		0.88			
	[-0.00]		[0.86]			
Behavioral Variables						
B/M mean	-1.453			-2.130**		
	[-1.00]			[-2.43]		
Tobin's Q stdev	-1.339*			-0.654*		
	[-1.78]			[-1.87]		
Other Variables						
Industry Concentration	-37.470*				-39.530**	-35.490*
	[-1.86]				[-2.02]	[-1.89]
Capacity Utilization (x100)	-5.800				-0.013	-0.012
	[-1.19]				[-0.31]	[-0.29]
D/E mean	0.302				0.328	0.549
	[0.32]				[0.41]	[0.67]
Excess Cash					-0.999	
					[-0.64]	
Cash mean	0.123					0.258
	[0.23]					[0.79]
Assets	-0.715				-0.943	-0.997
	[-0.35]				[-0.62]	[-0.66]
Constant	1.659	-6.397***	-6.088***	-4.441***	-2.881	-3.872
	[0.27]	[-9.23]	[-29.50]	[-7.42]	[-0.63]	[-0.81]
Correlation of predicted values with observed mergers	0.0244	0.0405	0.0242	0.0258	0.0159	0.0188
AIC	242.9388	402.8947	418.8409	416.8471	247.9302	246.9273
BIC	341.5290	440.4246	455.5792	453.8848	304.6121	317.7796

Statistical significance at the 1%, 5% and 10% levels is denoted by ***, **, and *, respectively. The T-statistic under the null hypothesis that parameter estimates equals zero, is given in the brackets.